

No. 23-2185

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**In the United States Court of Appeals  
for the Federal Circuit**



LYNK LABS, INC.,

*Appellant,*

-v-

HOME DEPOT U.S.A., INC.,

*Appellee.*

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On Appeal from the U.S. Patent and Trademark Office, No. PGR2022-00009

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**Opening Brief of Appellant Lynk Labs, Inc.**

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## **PATENT CLAIMS AT ISSUE**

### **U.S. Patent No. 10,932,341, Claims 1-5:**

1. An LED lighting device comprising: a first operating LED circuit and at least one additional LED circuit, at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and a switch capable of at least one of: (a) switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit, or (b) switching the at least one additional LED circuit on or off, wherein (a) or (b) is selectable by a user switching the switch, and wherein the LED lighting device is configured to connect to an AC voltage power source.

2. The LED lighting device of claim 1, wherein the switch has at least two positions.

3. The LED lighting device of claim 1, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

4. The LED lighting device of claim 1, wherein the switch is connected between the AC voltage power source and the LED lighting device.

5. The LED lighting device of claim 1, wherein the switching of the switch changes light output of the LED lighting device.

**U.S. Patent No. 10,932,341, Claims 7-12:**

7. The LED lighting device of claim 1, further comprising a driver electrically coupled to the switch and at least one of the first operating LED circuit or the at least one additional LED circuit.

8. An LED lighting device comprising: a first operating LED circuit and at least one additional LED circuit, at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and a switch capable of at least one of: (a) switching a brightness level of at least one of the first operating LED circuit or the at least one additional LED circuit, or (b) switching the at least one additional LED circuit on or off, wherein (a) or (b) is selectable by a user switching the switch, and wherein the LED lighting device is configured to connect to an AC voltage power source.

9. The LED lighting device of claim 8, wherein the switch has at least two positions.

10. The LED lighting device of claim 8, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

11. The LED lighting device of claim 8, wherein the switch is connected between the AC voltage power source and the LED lighting device.

12. The LED lighting device of claim 8, wherein the switching of the switch changes light output of the LED lighting device.

**U.S. Patent No. 10,932,341, Claims 14-19:**

14. The LED lighting device of claim 8, further comprising a driver electrically coupled to the switch and at least one of the first operating LED circuit or the at least one additional LED circuit.

15. An LED lighting device comprising: a first operating LED circuit and at least one additional LED circuit, at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and a switch capable of at least one of: (a) switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit, or (b) switching the at least one additional LED circuit on or off, wherein (a) or (b) is selectable by

switching the switch, and wherein the LED lighting device is configured to connect to an AC voltage power source.

16. The LED lighting device of claim 15, wherein the switch has at least two positions.

17. The LED lighting device of claim 15, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

18. The LED lighting device of claim 15, wherein the switch is connected between the AC voltage power source and the LED lighting device.

19. The LED lighting device of claim 15, wherein the switching of the switch changes light output of the LED lighting device.

## **CERTIFICATE OF INTEREST**

I certify the following information is accurate and complete to the best of my knowledge.

Respectfully submitted,

/s/ Stephen P. McBride  
*Counsel for Appellant Lynk Labs, Inc.*

**1. Represented Entity**

Lynk Labs, Inc.

**2. Real Party in Interest**

N/A

**3. Parent Corporation and Stockholders**

N/A

**4. Legal Representatives**

Other than counsel already entered an appearance in this court, the following counsel have made previous appearances in related or lower court proceedings:

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**5. Related Cases**

A Notice of Related Case Information was filed on July 31, 2023, ECF No. 4.

**6. Organizational Victims and Bankruptcy cases**

N/A

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### **STATEMENT OF RELATED CASES**

This is an appeal from the final written decision in *Home Depot USA, Inc., v. Lynk Labs, Inc.*, PGR2022-00009 (PTAB May 22 , 2023; Paper 38) by the United States Patent and Trademark Office Patent Trial and Appeal Board (“PTAB” or “Board”) for U.S. Pat. No. 10,932,341 (“the ’341 Patent”). Appx0001-0079 [FWD]. No appeal in or from the same proceeding in this PTAB was previously before this Court or any other appellate court.

### **JURISDICTIONAL STATEMENT**

The PTAB had jurisdiction under 35 U.S.C. § 6 over PGR2022-00009 that is the subject of this appeal. The PTAB issued its Final Written Decision in PGR2022-00009 on May 22, 2023. Appx0001-0079. Lynk timely filed its notice of appeal on July 17, 2023. Appx3683-3688. This Court has jurisdiction under 35 U.S.C. §§ 141(c), 319 and 28 U.S.C. § 1295(a)(4)(A).

## **STATEMENT OF THE ISSUES**

1. Whether the Board erred by holding the language of claims 4, 11 and 18 impossible on its face.
2. Whether the Board erred by construing the claim term “forward voltage” as “the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.”
3. Whether the Board, based on its construction for the claim term “forward voltage,” erred in holding claims 3, 10 and 17 impossible.
4. Whether the Board, based on its findings of impossibility of claims 3, 4, 10, 11, 17 and 18, erred in holding the '341 Patent is eligible for post grant review.

## STATEMENT OF THE CASE

This case is an appeal from the Board’s decision that all challenged claims 1-5, 7-12, and 14-19 of the ’341 Patent are unpatentable over certain references stated in Petitioner’s grounds. The decision is *Home Depot USA, Inc. v. Lynk Labs Inc.*, PGR2022-00009, Paper 38 (PTAB May 22, 2023). Appx0001-0079.

## THE ’341 PATENT

Patent Owner Lynk Labs, Inc. (“Lynk” or “Patent Owner”) is a practicing entity that manufactures and supplies its patented products to LED lighting manufacturers for various applications. Founded in 1997, Lynk is a pioneer in LED technology for the general lighting market.

### A. Technical Background

The general field of the ’341 Patent is LED lighting devices for multi-voltage level and/or multi-brightness level operation. Appx0095 [’341 Patent, 1:39-41]. The ’341 Patent “specifically relates to multiple voltage level and multiple brightness level light emitting diode circuits, single chips, packages and lamps ‘devices’ for direct AC voltage power source operation, bridge rectified AC voltage power source operation or constant DC voltage power source operation.” Appx0095 [’341 Patent, 1:41-46]. That is, the ’341 Patent discloses innovative LED lighting devices that can be driven using multiple voltages to provide multiple brightness levels. The ’341 Patent explains that it would be “advantageous to have a multi-voltage and/or multi-

brightness circuit that can provide options in voltage level, brightness level and/or AC or DC powering input power preference.” Appx0096 [’341 Patent, 3:1-4]. These LED circuits “can be of varied make up and can be combined with each other to create desired systems given the scalable and compatible arrangements possible with, and resulting from, the invention.” Appx0098 [’341 Patent, 8:6-10].

Figure 9 of the ’341 Patent illustrates one possible arrangement. In Figure 9, AC voltage source 78 is connected to an LED lighting device 62. Within the LED lighting device 62, bridge rectifiers rectify an AC voltage input to DC to drive their respective LED circuits.

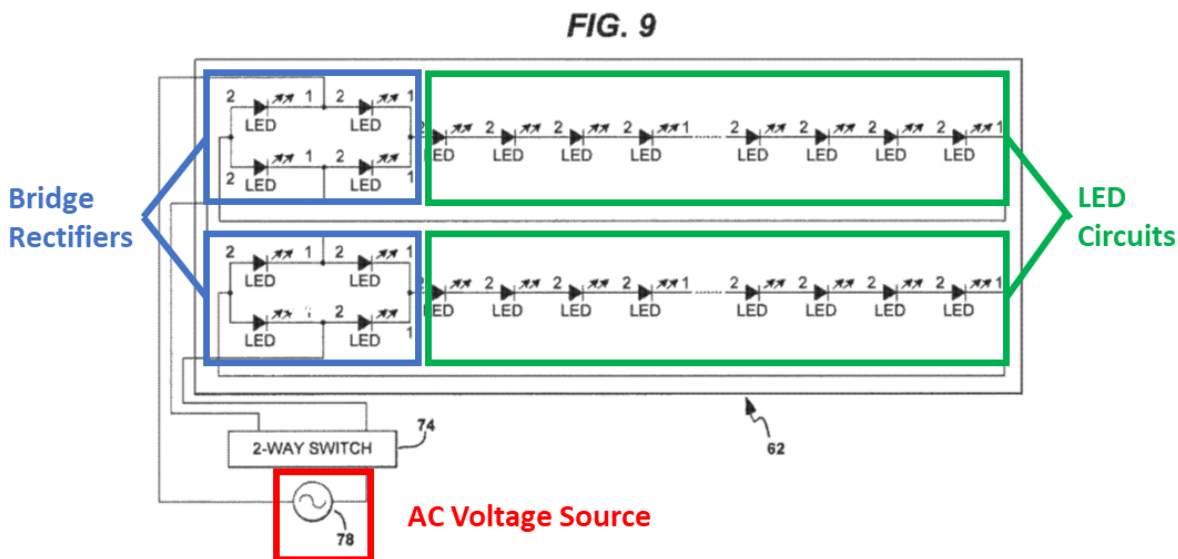


Figure 9 also illustrates a 2-way switch that can switch power to one or both LED circuits within LED lighting device 62. In doing so, the switch “form[s] a multi-voltage and/or multi-brightness LED device.” Appx0100 [’341 Patent, 11:36-39].

The LED circuits of the '341 Patent may be “configured to provide a means of switching on at least one additional single voltage AC LED circuit within the multi-voltage and/or multi-current AC LED circuit to provide increased brightness... .” Appx0098 ['341 Patent, 7:3-8].

The term “multi-voltage” in the '341 Patent relates to LED “circuits and devices that can be driven with more than one AC or DC forward voltage.” Appx0096 ['341 Patent, 3:12-19]. The '341 Patent explains several ways an LED circuit can switch between multiple forward voltages. For example, a multi-voltage LED circuit can be formed “by electrically connecting the two single voltage AC LED circuits in parallel and a second forward voltage drive level by electrically connecting the at least two single voltage level AC LED circuits in series.” Appx0096 ['341 Patent, 4:12-19]. This connection occurs via “a switching means that connects and/or disconnects at least one additional LED circuit to and/or from a first LED circuit.” Appx0096 ['341 Patent, 4:12-19]. When a circuit is added in a parallel configuration, the multi-voltage LED circuit operates at one forward voltage. When a circuit is added in a series configuration, the multi-voltage LED circuit operates at a second (higher) forward voltage.

The '341 Patent also teaches a second way to vary the forward voltage. An LED circuit's forward voltage may be varied by a “dimmer switch that ... allows for adjustability of the otherwise relatively fixed voltage ... output of the LED circuit

driver.” Appx0099 [’341 Patent, 9:17-24]. Thus, the ’341 Patent teaches a dimmer switch can be connected to an output of an LED circuit driver and used to adjust the voltage received by the LED circuit.

The term “multi-brightness” in the ’341 Patent relates to increasing either or both forward voltage and current across an LED circuit. For example, “switching on at least one additional single voltage AC LED circuit within [the] multi-voltage and/or multi-current AC LED circuit [ ] provide[s] increased brightness ... .” Appx0098 [’341 Patent, 7:3-8]. *See also id.*, Appx0095 [2:4-10]. Similarly, the ’341 Patent explains that “LED circuits get brighter as the voltage and/or frequency of the LED circuit driver output is increased to the LED circuits.” *Id.*, Appx0099 [9:22-24]. By connecting LED circuits in series to the multi-voltage LED circuit or by using a dimmer switch, forward voltage can be increased, thereby causing the brightness of the multi-voltage LED circuit’s light output to increase. Similarly, by connecting LED circuits in parallel to the multi-voltage LED circuit, current can be increased, which correspondingly increases brightness.

The term “LED circuit” in the ’341 Patent encompasses both multi-voltage LED circuits and single voltage LED circuits. Appx0096 [’341 Patent, 3:5-32]. LED circuits may be “the same or different colors” and may “require[e] different forward voltages and currents.” Appx0099 [’341 Patent, 9:7-9]. LED circuits can be driven

with “direct AC voltage coupling, bridge rectified AC voltage coupling or constant voltage DC power source coupling.” Appx0096 [’341 Patent, 3:5-11].

## **B. Challenged Claims**

The Petition challenged claims 1-5, 7-12, and 14-19 of the ’341 Patent. Claims 1, 8, and 15 are independent and directed to an LED lighting device. The remainder of the claims depend from independent claims 1, 8, and 15. The independent claims are directed to LED lighting devices comprising at least two LED circuits configured to emit different color lights, where the LED lighting device contains a switch that selects between switching voltage level inputs to the LED circuits or switching the LED circuits on or off. Additionally, the LED lighting device is configured to connect to an LED voltage power source.

The dependent claims recite further improvements on these concepts, including using at least two different DC forward voltages to the LED circuits, using switches to change the light output of the LED circuit, and using at least two different AC voltage power sources.

## **PRIOR ART REFERENCES**

The Petition asserts as prior art U.S. Pat. Pub. No. 2002/0070914 to Bruning et al. (“Bruning”), U.S. Pat. Pub. No. 2004/0164948 to Kabel et al. (“Kabel”), U.S. Pat. Pub. No. 2002/0048169 to Dowling et al. (“Dowling”), U.S. Pat. No. 6,016,038

to Mueller et al. (“Mueller”). Appx3102 [Pet., 4]. These are asserted in grounds 3-5 of the Petition. Appx3102-3103 [Pet., 4-5].

This appeal is limited to the issues of PGR eligibility and Grounds 1 and 2, which relate to § 112. Thus, the appeal does not discuss the prior art.

### **PROCEDURAL HISTORY**

The Petition (“Pet.”) for PGR2022-00009 was filed on November 12, 2021, challenging claims 1-5, 7-12, and 14-19. Appx3091-3184 [Pet., 1-94]. The Board instituted PGR2022-00009 in its decision dated May 25, 2022. Appx3264-3350 [Instn. Dec., 1-87]. The Patent Owner Response (“POR”) was filed on August 17, 2022. Appx3397-3475 [POR, 1-79]. The Petitioner filed a reply on November 9, 2022. Appx3511-3546 [Reply, 1-36]. The Patent Owner filed its sur-reply on December 21, 2022. Appx3547-3583 [Sur-reply, 1-37]. The oral hearing was conducted on February 28, 2023. Appx0083 [Certified List, 4]. The Board issued its Final Written Decision on May 22, 2023. Appx0001-0079 [FWD]. The Patent Owner timely filed its appeal on July 17, 2023. Appx3683-3688 [NOA].

The Petition asserts that claims 1-5, 7-12, and 14-19 of the ’341 Patent are unpatentable under five different grounds. Appx3102-3103 [Pet., 4-5].

## SUMMARY OF THE ARGUMENT

This appeal is based on the FWD's holding that several claims that are possible under their plain language are nonetheless impossible. The Board's holding disregards the plain language of the claims, as well as the intrinsic and extrinsic record and relevant legal authority.

The '341 Patent claims priority to several continuation applications. Some of these applications were filed before the AIA was implemented. As such, the '341 Patent is only eligible for post grant review if the Petitioner can carry its burden to show that one or more claims in post-AIA applications are not entitled to claim priority to these pre-AIA applications. The FWD relied on claims 3, 4, 10, 11, 17 and 18 from the '341 Patent to hold that the '341 Patent is eligible for post-grant review.

The FWD is erroneous because it *starts from the premise that the '341 Patent must be eligible for post-grant review* and works backwards, disregarding law and facts that contradict the foundation of its ultimate determination. According to the Board's rationale, claims 3, 4, 10, 11, 17 and 18 are, at best, entitled to the filing date of the '341 Patent (Jan. 10, 2020) because they lack support under 35 U.S.C. § 112. According to the Board, these claims lack support under 35 U.S.C. § 112 because they are impossible. But claims 3, 4, 10, 11, 17 and 18 are clearly possible on their face.

Claims 4, 11 and 18 recite “an LED lighting device comprising ... a switch ... wherein the switch is connected between [an] AC voltage power source and [an] LED lighting device.” Appx0100-0101 [’341 Patent, claims 4, 11 and 18]. Thus, the claim are directed to a switch in an LED lighting device that is connected between the lighting device and a power source. This is a typical arrangement of a lighting device such as a desk lamp. The Board held this claim impossible, reasoning the Patent Owner’s evidence “cannot show the claimed switch as being part of the claimed LED lighting device and at the same time being disposed between the voltage source and the claimed LED lighting device.” But the Board’s analysis reads the claim term “connected” out of the claim and assumes the “switch” itself—rather than its connection—must be between the lighting device and power source. On that basis, the Board held the claim impossible.

Claims 3, 10 and 17 require “the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.” Appx0100-0101 [’341 Patent, claims 3, 10 and 17]. The Board held that “Petitioner’s ‘impossibility of multiple minimum voltages’ arguments ... show a lack of written description ... as well as [ ] a lack of enablement, indefiniteness, and PGR eligibility.” Appx0040 [FWD]. Again, the claims at issue are clearly possible on their face—a switch simply switches between two different voltages for providing one of the voltages to one or more LED circuits. The Board’s

impossibility finding is not based on the claim language; instead, it is based on the adoption of an incorrect claim construction for “forward voltage” that conflicts with the plain and ordinary meaning of these claims.

As discussed below, the Board’s impossibility findings and claim construction are not supported by the language of the claims, the intrinsic record, the extrinsic record, or applicable legal authority. Thus, this Court should reverse, holding claims 3, 4, 10, 11, 17, and 18 are possible. Because the Board’s impossibility ruling is the basis for its finding of lack of support under § 112 and its finding of PGR eligibility, this Court should also reverse those findings.

## **ARGUMENT**

### **A. STANDARDS OF REVIEW**

Obviousness is a legal question based on underlying findings of fact. *Univ. of Strathclyde v. Clear-Vu Lighting LLC*, 17 F.4th 155, 160 (Fed. Cir. 2021). “We review the Board’s legal determination of obviousness de novo and its factual findings for substantial evidence.” *Outdry Technologies Corporation v. Geox S.P.A.*, 859 F.3d 1364, 1367 (Fed. Cir. 2017) (citing *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015)); *TQ Delta, LLC v. Cisco Systems, Inc.*, 942 F.3d 1352, 1357 (Fed. Cir. 2019) (legal determination reviewed de novo).

The Federal Circuit reviews legal conclusions *de novo*. *AC Technologies S.A. v. Amazon.com, Inc.*, 912 F.3d 1358, 1364 (Fed. Cir. 2019) (“We consider de novo

the Board’s legal conclusions.”); *In re Stepan Co.*, 868 F.3d 1342, 1345 (Fed. Cir. 2017). De novo review means the review is conducted anew, without deference to the Board. See *Motionless Keyboard Co. v. Microsoft Corp.*, 486 F.3d 1376, 1379 (Fed. Cir. 2007).

The substantial evidence standard for issues of fact is satisfied if a reasonable mind could arrive at the finding based on the evidence of record. *Consol. Edison Co. v. NLRB*, 305 U.S. 197, 217 (1938). “Substantial evidence is more than a mere scintilla. It means such relevant evidence as a reasonable mind might accept as adequate to support a conclusion.” *Id.* at 216. The substantial evidence standard asks ‘whether a reasonable fact finder could have arrived at the agency’s decision.’” *OSI Pharms., LLC v. Apotex Inc.*, 939 F.3d 1375, 1381–82 (Fed. Cir. 2019) (quoting *In re Gartside*, 203 F.3d 1305, 1312 (Fed. Cir. 2000)).

Substantial evidence review is more than “simply rubber-stamping agency factfinding.” *OSI Pharm.*, 939 F.3d at 1382 (quoting *Dickinson v. Zurbo*, 527 U.S. 150, 162 (1999)). It asks “whether a reasonable fact finder could have arrived at the agency’s decision” and involves an “examination of the record as a whole, taking into account evidence that both justifies and detracts from an agency’s decision.” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1366 (Fed. Cir. 2016).

This Court “review[s] questions of claim construction de novo.” *Qualcomm Inc. v. Intel Corp.*, 6 F.4th 1256, 1266 (Fed. Cir. 2021) (citing *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1346 (Fed. Cir. 2015)); see, e.g., *PPC Broadband, Inc. v. Corning Optical Communications RF, LLC*, 815 F.3d 734, 739 (Fed. Cir. 2016).

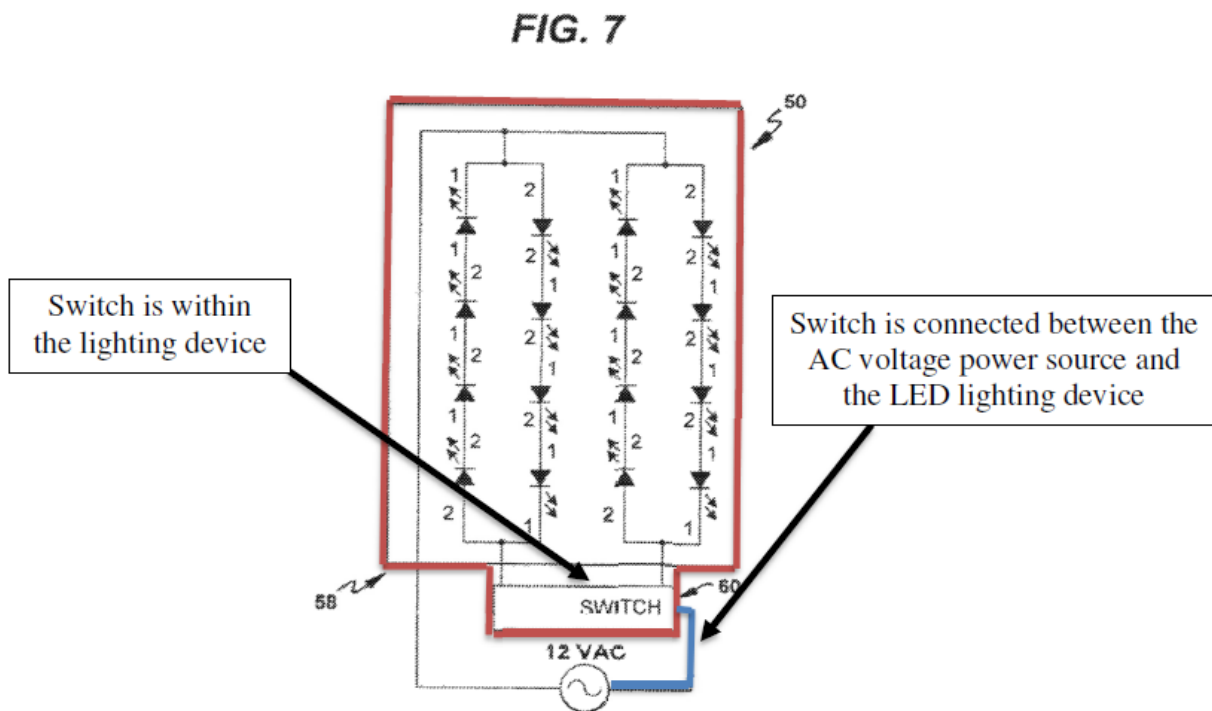
## **B. CLAIMS 4, 11, AND 18 ARE POSSIBLE**

The Final Written Decision held that claims 4, 11 and 18 were impossible and therefore lack written description, are not enabled, and are indefinite. Appx0043 [FWD]. The Board’s decision misconstrues the language of the claims.

Claim 4 of the ’341 Patent recites “the LED lighting device of claim 1, wherein the switch is connected between the AC voltage power source and the LED lighting device.” Appx0100 [’341 Patent, claim 1]. The LED lighting device of claim 1 comprises a switch. *Id.* Claims 11 and 18 are identical except that they depend from independent claims 8 and 15, respectively. Appx0101 [’341 Patent, claims 11 and 18].

As shown in the annotated version of Figure 7 of the ’341 Patent below, the claimed switch can be both within the LED lighting device and “connected between the AC voltage power source and the LED lighting device.” In particular, the **connection** between the AC voltage power source and the switch (shown in blue) is literally “between the AC voltage power source [the 12VAC circle] and the LED lighting device [characterized by the red box]” as required by the claim. Even Home

Depo's expert conceded as much. *See, e.g.*, Appx2865 [Neikirk Tr., 46:3-12] (“Q: And do you see the line between voltage source 12 VAC and switch 60 [of Fig. 7]? A. I do. Q. Does that represent the connection between the voltage source and the switch 60? A. [ ] Yes, I would assume it does...”). At the same time, the switch is still part of the LED lighting device.



The Board states “Patent Owner’s annotated version of Figure 7 still would not support a finding that the switch 60 is *between* LED lighting device 50 and the AC voltage source.” Appx0046 [FWD]. The Board’s rational reads the claim term “connected” out of the claim. Claims 4, 11, and 18 do not require the “*switch is between*” an LED lighting device and the AC voltage source as stated by the

Board. Instead, these claims require “the switch is ***connected*** between the AC voltage power source and the LED lighting device.” Appx0100-0101 [’341 Patent, claims 4, 11, and 18] (emphasis added). That is, the claims require the connection to be between the power source and LED lighting device, just as Patent Owner’s annotated Fig. 7 shows.

This Court has held that “rewriting the claims” to cure impossibility is improper. *Synchronoss Technologies, Inc. v. Dropbox, Inc.*, 987 F.3d 1358 (Fed. Cir. 2021). For the same reason, rewriting the claims to ***create*** impossibility (as done by the Board) is also improper. The Board’s conclusion otherwise assumes impossibility of the claims based on a misstatement of the claim language.

Similarly, the Board states that the arrangement above does not “support a finding that the claimed ‘switch’ could be part of the LED lighting device of independent claims 1, 8, and 15 and also be ‘connected between the AC voltage power source and the LED lighting device,’ as recited in claims 4, 11, and 18.” Appx0046-0047 [FWD]. But this statement directly contradicts Patent Owner’s explanation, which shows one possible configuration where (a) the “LED lighting device comprises ... a switch” and (b) the “switch is connected between the AC voltage power source and the LED lighting device.” In particular, the switch is

plainly connected to the AC voltage power source by the wire marked in blue, which is “between an AC voltage power source and the LED lighting device.”

The FWD also implies the '341 Patent may lack support for claims 4, 11, and 18. Appx0046 [FWD] (“Even assuming, *arguendo*, Patent Owner could cite to any support...”).<sup>1</sup> The Board’s implication is wrong for two reasons. First, this issue would be outside the scope of arguments presented in the Petition and argued to the Board. The Petition never advanced the argument that claims 4, 11, and 18 lack support in the specification. Instead, the Petition argued solely that claims 4, 11, and 18 are impossible on their face and therefore “invalid as indefinite [and for] lack of written description and lack of enablement.” Appx3130-3131 [Petition, 32-33]. Thus, the Board’s discussion of support in the specification is beyond the scope of the arguments presented and argued.

Second, claims 4, 11, and 18 *are* supported by the intrinsic record. Figures 7 and 9 both disclose a switch “connected between the AC voltage power source and the LED lighting device” as required by the claims. Appx0091, 0093 [’341 Patent, Figs 7 and 9]. For example, Fig. 9 discloses “a switch 74 electrically

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<sup>1</sup> The FWD cites to prior applications in the '341 Patent’s priority chain to reach its conclusion that the '341 Patent lacks § 112 support. Appx0045-0047 [FWD]. The FWD appears to be conflating the issue of PGR eligibility with the issue of impossibility. For purposes of this section, which relates solely to whether the claims are impossible on their face, only the '341 Patent disclosure is relevant.

connected between the multi-brightness LED lighting device 62 and the AC voltage source 78.” Appx0100 [’341 Patent, 11:40-43]. *See id.*, Appx0100 [’341 Patent] 11:18-22] (describing the same arrangement for Fig. 7). This is exactly what claims 4, 11, and 18 recite.

To the extent the FWD characterizes the ’341 Patent as lacking support for “an LED lighting device comprising ... a switch” as required by the independent claims, it is incorrect. The ’341 Patent expressly describes embodiments where the switch is part of the LED lighting device. For example, the ’341 Patent discloses “a multi-voltage and/or multi-current single chip AC LED ... is integrated within an LED lamp.” Appx0097-0098 [’341 Patent, 6:65-7:1]. In this configuration, “[t]he multi-voltage and/or multi-current single chip AC LED [ ] is configured to provide a means of switching [ ] to provide increased brightness from the LED lamp.” Appx0098 [’341 Patent, 7:3-7:8]. Further, the ’341 Patent is clear that an LED lighting device may be a lamp. Appx0100 [’341 Patent] 11:14-17] (“It is contemplated that the [ ] LED lighting device 50 is [ ] an LED lamp.”). Additionally, the ’341 Patent is clear that its various LED circuits “can be of varied make up and can be combined with each other... .” Appx0098 [’341 Patent, 8:6-10].

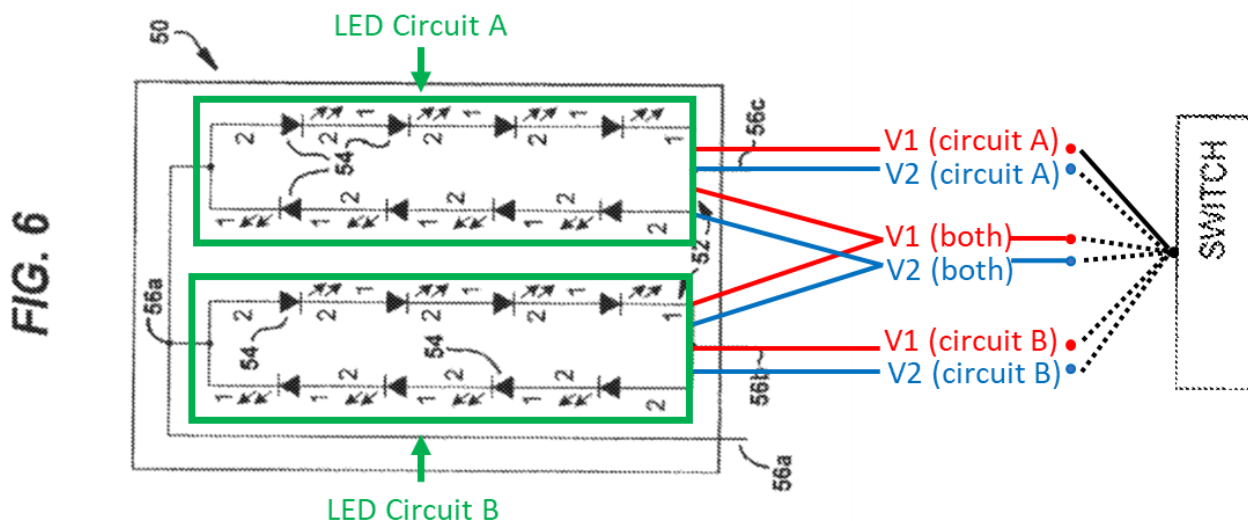
Accordingly, the FWD should be reversed because claims 4, 11 and 18 of the '341 Patent are possible.

**C. CLAIMS 3, 10, AND 17 ARE POSSIBLE**

**1. Claims 3, 10, and 17 are possible under the plain and ordinary meaning of “two different DC forward voltages”**

Claim 3 recites “[t]he LED lighting device of claim 1, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.” Appx0100 ['341 Patent, claim 3]. Claims 10 and 17 are identical, except they depend from independent claims 8 and 15, respectively. Appx0100 ['341 Patent, claim 3].

These claims are plainly possible on their face. They require a switch that can provide one of two different voltages to either or both of two LED circuits. One (of many) possible arrangements is shown below (using '341 Patent Figure 6 to help illustrate), in which a switch has six positions—one to provide first voltage V1 to LED circuit A, a second to provide second voltage V2 to LED circuit A, a third to provide V1 to LED circuit B, a fourth to provide V2 to LED circuit B, a fifth to provide V1 to both circuits at the same time, and a sixth to provide V2 to both circuits at the same time:



Nor do these claims lack support in the specification. Independent claims 1, 8 and 15 recite two LED circuits (the “first operating LED circuit” and the “at least one additional LED circuit”) that have different colors. Appx0100-0101 [’341 Patent, claims 1, 8 and 15]. The specification discloses that LED circuits may be “the same or different colors,” thus the specification discloses two LED circuits with different colors. Appx0099 [’341 Patent, 9:7-9].

Claims 3, 10, and 17 recite that the two different color LED circuits receive “at least two different DC forward voltages.” Appx0100-0101 [’341 Patent, claims 3, 10, and 17]. Thus, the “first operating LED circuit” and “at least one additional LED circuit” are both multi-voltage circuits. The specification teaches LED circuits “that can be driven with more than one AC or DC forward voltage ‘multi-voltage.’” Appx0096 [’341 Patent, 3:12-16].

Claims 3, 10, and 17 require a switch to provide the multiple voltages. Appx0100-0101 ['341 Patent, claims 3, 10 and 17]. The specification teaches “a switching means that connects and/or disconnects” LED circuits to achieve multiple forward voltages. Appx0096 ['341 Patent, 3:16-19]. The specification also teaches a “dimmer switch” that adjusts the voltage input to the LED circuits. Appx0099 ['341 Patent, 9:17-21].

The FWD argues that the patent does “not address the situation in which (1) the two different DC forward voltages are provided to *only* the first operating LED circuit, nor the situation in which (2) two different DC forward voltages are provided to *only* the at least one additional LED circuit.” Appx0035 [FWD]. But as discussed above, the claims require two multi-voltage LED circuits (each with a different color) and the specification clearly discloses switching between multiple voltages in a multi-voltage LED circuit. Further, the specification teaches its embodiments “can be combined with each other to create desired systems given the scalable and compatible arrangements possible with, and resulting from, the invention.” Appx0098 ['341 Patent, 8:6-10]. The specification teaches that “LED circuits” with “different colors” (Appx0099 ['341 Patent, 9:7-9]) and that each LED circuit can be a “multi-voltage LED circuit.” Appx0096 ['341 Patent, 3:12-16].

Further, “as a general rule, the words ‘a’ or ‘an’ in a patent claim carry the meaning of ‘one or more.’” *TiVo, Inc. v. EchoStar Commc'ns Corp.*, 516 F.3d 1290,

1303 (Fed. Cir. 2008). The claim term “a switch” does not preclude the use of multiple switches, or of one switch that controls multiple LED circuits. This is supported by the specification. In various embodiments, the specification uses terms such as “switching means” (Appx0096 [’341 Patent, 3:17-19]) and “switching process” (Appx0100 [’341 Patent 11:31-35]) that clearly encompass one or more switches.

The Board’s analysis demands the specification disclose the language of the claims word-for-word. But the written description requirement “does not demand ... that the specification recite the claimed invention *in haec verba*.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1352 (Fed. Cir. 2010). Instead, “the test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Id.*, 1351. The various limitations of claims 3, 10, and 17 are each described in the specification and are described as being “combin[able]” and “scalable.” Appx0098 [’341 Patent] 8:6-10]. Thus, the Board’s analysis is incorrect. At a minimum, one skilled in the art would have understood from the specification that the inventor possessed switching voltage levels to two different color multi-voltage LED circuits as required by claims 3, 10, and 17.

Finally, the FWD does not dispute that the claims are possible on their face under any construction of the term “forward voltage” that does not require “forward

voltage” to be a single value for each LED circuit.<sup>2</sup> Instead, the FWD bootstraps its impossibility argument on its incorrect claim construction for the term “forward voltage.” As discussed below, the Board’s construction is wrong.

## **2. “Forward Voltage” Claim Construction**

### **i. The proper construction for “forward voltage” is “the operating voltage for the claimed LED circuit”**

The term “forward voltage” in the ’341 Patent should be construed as the operating voltage for the claimed LED circuit.

The term “forward voltage” is present in dependent claims 3, 10, and 17. Appx0100-0101 [’341 Patent, claims 3, 10, and 17]. Each of these claims is substantially similar. Claim 3 is representative and is reproduced below:

3. The LED lighting system of claim 1, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

*Id.*

Per the express language of claim 3, a forward voltage is the voltage “provide[d]” to the claimed “operating LED circuit.” Appx0100 [’341 Patent, claim

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<sup>2</sup> Both Patent Owner’s proposed construction and Petitioner’s alternate construction allow for multiple forward voltages across a single LED circuit. *See* §§V.C.2.i, V.C.2.iii.

3]. This is essentially Patent Owner’s construction. Patent Owner’s construction uses the term “operating” voltage for the LED circuit to clarify that the claim requires voltage in a range that will cause the LED circuit to “operat[e]”—that is, illuminate in the manner intended. If the forward voltage were zero, or below the minimum turn on voltage, the LED circuit would not provide light and would not be an “operating LED circuit.” If the forward voltage were above the maximum operating voltage for that particular LED circuit, a number of undesirable effects could occur, including LED failure, a shorter LED life, a shift away from the intended color or intensity, and/or excessive heat generation. Under any of these conditions, the LED circuit would not operate as intended.

The claims also expressly require “forward voltage” to be *a range of voltages*. Appx0100 [’341 Patent], claim 1 (“switching a voltage level input” to the operating LED circuit), claim 3 (“the switching of the switch provides at least two different DC forward voltages.”). Thus, the “forward voltage” is the “operating voltage.”

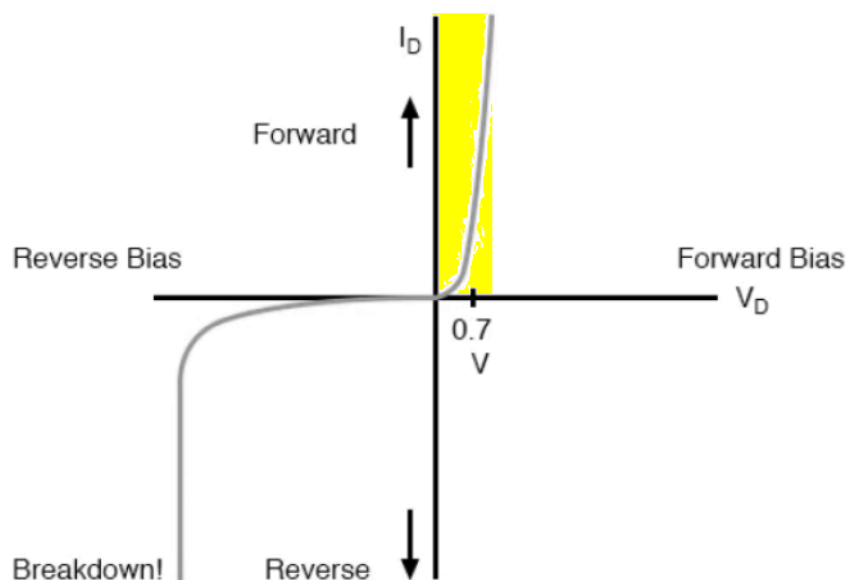
The specification supports Patent Owner’s construction. *Phillips*, 415 F.3d at 1315 (“the specification ‘is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.’”) (internal citation and quotation omitted). The title of the ’341 Patent is “multi-voltage and multi-brightness LED lighting devices and methods of using same.” Appx0084 [’341 Patent, Title]. *See also id.*, 1:25-29 (“The present invention

specifically relates to multiple voltage level and multiple brightness level LED devices, packages and lamps.”), 1:41-46 (same). Thus, ’341 Patent comprises providing multiple forward voltages to LED lighting devices to change the brightness of the LED circuit.

Likewise, the specification repeatedly discusses that the forward voltage “drives” the LED circuit. *See, e.g.*, Appx0096-0097 [’341 Patent, 3:12-14] (“This invention comprises circuits and devices that can be driven with more than one AC or DC forward voltage ‘multi-voltage’ at 6V or greater ... .”); 4:33-35 (“each single voltage series LED circuit is designed to be driven with a predetermined forward voltage...”); 4:38-40 (“each multi-voltage AC or DC LED device would be able to be driven with at least two different AC or DC forward voltages...”); 5:1-5 (referencing a first and second “forward voltage drive level.”), 5:47-54 (same). The term “drives” underscores that the forward voltage must be in the range sufficient to operate the LED circuit—that is, to turn on the LED circuit at the desired light intensity. Thus, “the drive voltage level and/or the brightness level selectability [ ] may be selected by the LED package user.” Appx0084 [’341 Patent, Abstract.] If the forward voltage were not within the operating range, it would not drive the LED circuit and there would be no “brightness level.”

The extrinsic record confirms Patent Owner’s construction. A basic property of diodes is that they have a range of forward voltages that may be applied for the

diode to operate and are not limited to a single minimum voltage. For example, one electrical engineering textbook discloses that “[t]he voltage dropped across a conducting, forward-biased diode is called the *forward voltage*.” Appx2939-2947 [Ex 2011 All About Circuits]. As can be seen in the graph below, the forward voltage (labelled “Forward Bias”) for this particular diode varies from a minimum of about .5V to a maximum of about .9V depending on the current applied. Appx2755-2756 [Bretschneider Decl., ¶49].



The above disclosure indicates that for even a single diode, the forward voltage will vary depending on the current applied. This confirms there is no single, fixed forward voltage for an LED circuit as the Board asserts. A POSITA reviewing the '341 Patent would readily understand that the forward voltage must be within

the operating range (i.e., the operating voltage) for the specific LED circuit being driven. Appx2756-2757 [Bretschneider Decl., ¶50]. Again, this is because forward voltages outside of this range would not result in an “operating LED circuit.” Appx2756-2757 [Bretschneider Decl., ¶50]. Designing LED circuits with forward voltages within operating ranges is critical. LED circuits are designed to operate with specific voltages and currents depending on the configuration and specifications of the LEDs. A POSITA would understand that LED circuits would not be designed with forward voltages outside of the operating range. Appx2756-2757 [Bretschneider Decl., ¶50].

Accordingly, a POSITA would understand that the term “forward voltage” in the '341 Patent should be construed as the operating voltage for the claimed LED circuit.

**ii. The Board’s construction is incorrect**

The FWD incorrectly adopted a construction of “forward voltage” as “the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.” (Appx0023 [FWD]). The Board’s construction is based *entirely* on a statement in the prosecution history of the parent patent that “the ‘forward voltage’ of an LED circuit, as recited in claim 1 [of the parent patent], is the minimum voltage difference required between

the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.” Appx2153 [Ex 1023] 9].

“Claim language and the specification generally carry greater weight than the prosecution history.” *HTC Corp. v. IPCom GmbH & Co.*, 667 F.3d 1270, 1276 (Fed. Cir. 2012). *See also Phillips*, 415 F.3d at 1317 (“[B]ecause the prosecution history represents an ongoing negotiation between the PTO and the applicant, rather than the final product of that negotiation, it often lacks the clarity of the specification and thus is less useful for claim construction purposes.”). The FWD decision states that “Patent Owner’s arguments [ ] urge us to ignore the intrinsic evidence (e.g., prosecution history disclaimer) in favor of extrinsic evidence (e.g., diode manufacturing specification data sheets).” This is incorrect. Patent Owner’s arguments before this Court and the Board begin with the language of the claims and the specification. *Phillips*, 415 F.3d at 1314. The FWD does not address these arguments, nor does it address the unrebutted extrinsic evidence Patent Owner introduced to corroborate its construction.

Instead, the FWD focuses almost entirely on a single sentence from the prosecution history. But even there, the Board fails to address the context of the statement within the larger prosecution history and the intrinsic record as a whole. Read in context, the above statement from the parent prosecution history confirms that an LED can have multiple forward voltages.

**a. The FWD fails to show that prosecution history disclaimer applies**

The Board's construction rests entirely on its incorrect characterization of a statement from the file history of the parent '164 Application as an "express definition" of forward voltage. Appx0017, Appx0024-0025 [FWD]. The Board's incorrect construction is based on an excerpt of applicant's response to a rejection during prosecution of the '164 application. Appx2145-2156 [Ex1023]. The '164 Application is the parent application to the '341 Patent and issued as the '001 Patent.

"The words of a claim are generally given their ordinary and customary meaning as understood by a person of ordinary skill in the art." *Thorner v. Sony Computer Entertainment of America LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) (citing *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).) "There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Id.* Where the specification reveals "a special definition given to a claim term by the patentee that differs from the meaning it would otherwise possess," then the "inventor's lexicography governs." *Phillips*, 415 F.3d at 1316.

However, there is no express definition or disavowal of claim scope in the specification of the '341 Patent, and, as discussed below, the claims and the

specification of the '341 Patent directly contradict the Board's construction. *See infra*, §§V.C.2.ii.b, V.C.2.ii.c. Where, as here, the Board relies on prosecution history by itself to limit the clear language of the claims and specification, the doctrine of prosecution disclaimer applies. “[F]or prosecution disclaimer to attach, [ ] the alleged disavowing actions or statements made during prosecution be both clear and unmistakable.” *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1325–26 (Fed. Cir. 2003). *See, e.g., Lazare Kaplan Intern., Inc. v. Photoscribe Technologies, Inc.*, 628 F.3d 1359 (Fed. Cir. 2010) (“To the extent that the Defendants contend that these statements amount to a disclaimer of subject matter, these statements fall short of the clear and unmistakable disavowal necessary for the doctrine of prosecution disclaimer to apply.”). “There is no ‘clear and unmistakable’ disclaimer” where, as here, “a prosecution argument is subject to more than one reasonable interpretation, one of which is consistent with a proffered meaning of the disputed term.” *OI Communique Lab'y, Inc. v. LogMeIn, Inc.*, 687 F.3d 1292, 1297 (Fed. Cir. 2012). Further, “clearly describing a particular claim term to overcome [a] rejection is not the same as clearly disavowing claim scope.” *Continental Circuits. LLC v. Intel Corp.*, 915 F.3d 788, 798–99 (Fed. Cir. 2019)

The FWD held that “[d]uring prosecution, Applicant [ ] made clear that the claimed ‘forward voltage of 6V or greater’ excludes a 120V AC voltage from a wall outlet.” Appx0024 [FWD]. But the issue in this IPR is different. The issue is not

whether “a forward voltage of 6V or greater” can be a 120V AC voltage from a wall outlet. Instead, the issue is whether an LED circuit can have “at least two different DC forward voltages” as required by claims 3, 10, and 17. Thus, the Board is applying prosecution history estoppel to a different issue than the issue addressed during prosecution of the ’164 Application. *01 Communique*, 687 F.3d at 1298 (Fed. Cir. 2012) (finding no prosecution history estoppel when the relevant “statements addressed another point entirely” than the point addressed in the district court.)

The Board states that “[w]hen a claim is not ambiguous, we do not read limitations into the claim to preserve its validity.” Appx0025 [FWD] (citing and quoting *Bennett Regul. Guards, Inc. v. Atlanta Gas Light Co.*, 825 F. App’x 773, 777 (Fed. Cir. 2020). The Board’s analysis flips *Bennett* on its head. In contrast to reading a limitation into an unambiguous claim to *preserve its validity* (as was the issue in *Bennett*), the Board’s construction reads a limitation into an unambiguous claim to *create invalidity* (i.e., impossibility).

Both approaches are incorrect. The general rule is that “the words of a claim are generally given their ordinary and customary meaning” regardless of whether that meaning tends to preserve (or destroy) validity. *Phillips*, 1312-1313; *see also Bennett*, 825 F. App’x at 777. There is no ambiguity here that the common and ordinary understanding of the term “forward voltage” (as acknowledged in both Patent Owner’s construction and Petitioner’s alternate construction) is that an LED

may have a range of (multiple) forward voltages. *See* §§V.C.2.i, V.C.2.iii. Indeed, Petitioner bases its invalidity positions with respect to claims 3, 10, and 17 on prior art references that purportedly provide at least two different DC forward voltages to an LED circuit. Appx3139 [Pet., 41] (“Bruning discloses ... wherein the switching of the switch ... provides at least two different DC forward voltages (voltages VR0, VG0, VB0 with maximum magnitudes that are a function of the duty cycle of switch Q1) to at least one of the first operating LED circuit...”). It is the Board that is reading limitations into the claims, and the Board is doing so not to simply narrow the claim, but instead to render the claims unintelligible.

The FWD argues that, by distinguishing the prior art reference Colby (which is not at issue in this PGR) on the basis that a 120V AC voltage from a wall outlet is not “*the minimum voltage* difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs,” the applicant disavowed any LED having more than one forward voltage:

Applicant distinguished Colby on the basis that the 120V AC voltage from a wall outlet is not “*the minimum voltage* difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.” *See* Ex. 1023, 9 (emphasis added). Applicant’s argument specifically identifies the claim language at issue—“forward voltage of 6V or greater”—and specifically states that it is not disclosed because Colby does not disclose *the minimum voltage* and *instead*, discloses something else, something larger— 120V AC voltage. Accordingly, we conclude that Applicant disclaimed any voltage that is more than “the

minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs” from the scope of “forward voltage.”

Appx0025 [FWD].

The FWD’s analysis is incorrect for a number of reasons. First, prosecution history statements stripped “from their context provid[e] an incomplete and ultimately inaccurate characterization” of disclaimer. *Opticurrent, LLC v. Power Integrations, Inc.*, No. 2021-1712, 2022 WL 539158, at \*5 (Fed. Cir. Feb. 23, 2022). The context of the ’001 Patent file history is clear that the Applicant did not intend to disclaim any interpretation of forward voltage other than a single minimum voltage. The Examiner rejected claim 1 of the ’164 Application over the prior art reference Colby. Appx2153 [Ex. 1023, 9]. In response, the Applicant amended claim 1 of the ’164 Application to include the limitation “wherein the first operating LED circuit and the at least one additional LED circuit both have a forward voltage of 6V or greater.” Appx2153 [Ex. 1023, 9]. The limitation at issue (“a forward voltage of 6V or greater”) is not present in the ’341 Patent, which instead claims “two different DC forward voltages.” Appx0100-0101 [’341 Patent, claims 3, 10, and 17]. Notably, the ’341 Patent claims “voltages” plural, not “a ... voltage” singular as is the case for the ’164 Application. To the extent the Applicant disclaimed any interpretation of “a forward voltage of 6V or greater” having multiple voltages, the limitation in the ’341 Patent of “two different DC forward voltages” expressly differentiates from

the limitation in the '164 Application by requiring two different forward voltages. Thus, the claim language at issue in the '341 Patent is materially different than the claim language in the '164 Application.

The issue addressed in the '164 Application file history was also materially different. There, the Examiner rejected the claims based on Colby's disclosure of an AC voltage provided by a wall outlet. Applicant amended the claims to include the limitation "wherein the first operating LED and the at least one additional LED circuit both have a forward voltage of 6V or greater" (Appx2147 [Ex 1023, 3]) and argued that the "recited forward voltage [of an LED] is different from the AC voltage provided by a typical wall outlet." Appx2153 [Ex. 1023 June 13, 2019 Remarks, 9]. The issue of whether a wall outlet can provide a forward voltage for an LED circuit is not relevant to the arguments made in this PGR. Nor is the prior art Colby reference that Applicant was responding to in the '001 Patent file history at issue in this PGR. The issue addressed by Applicant (i.e., whether a wall outlet could supply forward voltage to an LED circuit) is materially different than the issue in this PGR (i.e., whether an LED circuit can have at least two different DC forward voltages.) *01 Communique*, 687 F.3d at 1298 (Fed. Cir. 2012).

Notably, the Applicant's response qualified its statement to be limited to the then-current version of claim 1 of the '164 Application. *Id.* ("the 'forward voltage' of an LED circuit, *as recited in claim 1...*", "*the recited* forward voltage is different

from the AC voltage provided by a typical wall outlet”) (emphasis added). Thus, the Applicant is stating that the claimed “a forward voltage of 6V or greater” with respect to claim 1 of the ’164 Application is “the minimum voltage difference required between the anode and cathode of the LEDs in the *claimed* circuit.” (emphasis added). Applicant is expressly limiting its statement to “forward voltage of 6V or greater,” as used in claim 1 of the ’164 Application. No similar language is present in any of the claims of the ’341 Patent. On its face, Applicant’s statement applies only to a different issue in the then-pending version of claim 1 of the ’164 Application. This qualified statement does not “clearly express an intent to redefine the term” (*Thorner v. Sony Computer Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012)), much less meet the more demanding standard for prosecution history disavowal. Thus, it is not a clear and unmistakable disavowal of claim scope applying to the materially different claims of the ’341 Patent.

This highlights the material distinction between the claim language of the ’164 Application (“a forward voltage of 6V or greater”) and the ’341 Patent (“two different DC forward voltages”). Claim 1 of the ’164 Application requires “*a* forward voltage”—that is, a single forward voltage—so, understandably, as used in claim 1, the “forward voltage” is limited to “a” single forward voltage. The issue of whether an LED (or LED circuit) can have multiple forward voltages was not at issue. The ’341 Patent, on the other hand, expressly claims embodiments that go

beyond a single forward voltage and provide “two different DC forward voltages”—that is, voltages plural—to a single LED circuit. An example from the ’341 Patent is a dimmer switch that adjusts the current (and voltage) across a single LED circuit. Appx0099 [’341 Patent, 9:17-24].

The Board’s application of prosecution history disclaimer is also contradicted by the website that the Applicant cited ([www.baldengineer.com/led-basics.html](http://www.baldengineer.com/led-basics.html)) in its prosecution response for the ’164 Application. Appx2153 [Ex. 1023], 9; Appx3973-3004 [Ex. 2014]. The website states that “[t]he ‘Forward Voltage’ rating of a diode will determine the minimum voltage difference between the anode and cathode to allow current to flow.” Appx2974 [Ex. 2014, 2]. This statement does not say the forward voltage *is* the minimum voltage difference, it says the forward voltage *determines* the minimum voltage difference. Ex. 2014 goes on to explain that the “forward voltage defines the amount of voltage required for the current to flow ... . Any voltages below this level cause the LED to remain ‘open’ or non-conductive.” Thus, the website is drawing a distinction between forward voltage and minimum voltage—the forward voltage rating *determines* or *defines* the minimum voltage, but is not necessarily limited to that minimum voltage.

Further in the discussion, the Bald Engineer reference cites to data sheets showing that LEDs have a forward voltage operating range, including a minimum and maximum voltage:

ITEMS	Symbol	Test condition	Min.	Typ.	Max.	Unit
Forward Voltage	$V_f$	$I_f=20\text{mA}$	1.8	---	2.2	V

Appx2976 [Ex. 2014, 4]. *See id.*, 5 (“[t]he goal is to set the Forward Current for the LED at 20mA which means the LED will drop 1.8-2.2V.”). Again, the Bald Engineer reference cited in support of Applicant’s arguments in the ’164 Application response confirms that an LED can have multiple forward voltages. This is inconsistent with the Board’s construction and consistent with PO’s proposed construction because it shows a range of possible forward voltages for a single exemplary LED. Accordingly, the Board’s construction should be rejected.

It is a bedrock principle of patent law that “the claims are ‘of primary importance, in the effort to ascertain precisely what it is that is patented.’ *Phillips*, 415 F.3d at 1312 (*quoting Merrill v. Yeomans*, 94 U.S. 568, 570, 24 L.Ed. 235 (1876)). Further, “the prosecution history ... often lacks the clarity of the specification and thus is less useful for claim construction purposes” than the specification. *Phillips*, 415 F.3d at 1317. *Phillips*’ guidance is especially instructive here, where the statement Petitioner relies upon for its construction comes from the file history for a different patent (the ’001 Patent) discussing different claims (requiring LED circuits that have “a forward voltage of 6V or greater”) in the context of prior art (Colby) that is not at issue here. *See, e.g.*, Appx2153 [Ex. 1023 at 9]. As

discussed above, the claims and specification of the '341 Patent repeatedly and unambiguously require that LED circuits have multiple forward voltages. *See* §V.C.2.i. The statement from the prosecution history is expressly limited to different claims in a different patent and involves issues and prior art that are not present in this PGR. Accordingly, the Board's construction should be rejected under *de novo* review because there has been no clear and unmistakable disavowal of claim scope. *Continental Circuits*, 915 F.3d at 798–99.

**b. The Board's construction contradicts the claims of the '341 Patent**

Claims 3, 10, and 17 *require “two different DC forward voltages” to an “operating LED circuit.”* Appx0100-0101 ['341 Patent, claims 3, 10 and 17]. That “two different ... voltages” is not a “single” voltage (as held by the Board) is “readily apparent event to lay judges.” *Phillips*, 415 F.3d at 1314. Thus, claim construction here should “involve[] little more than the application of the widely accepted meaning of commonly understood words.” *Phillips*, 415 F.3d at 1314.

Adopting the Board's construction for “forward voltage” ignores the express language of the claims. *Id.* at 1312 (“the claims of a patent define the invention to which the patentee is entitled the right to exclude.”) (internal citations and quotations omitted). This is not a case where prosecution history disclaimer is argued to exclude a potential embodiment or limit the scope of a claim; instead, the Board's flawed

application of prosecution history disclaimer renders the commonly understood words “two different DC forward voltages” nonsensical. And the term “two different DC forward voltages” is central to the ’341 Patent. Indeed, the “invention specifically relates to multiple voltage level [ ] LED devices.” Appx0095 [’341 Patent, 1:26-28].

“[T]he context of the surrounding words of the claim also must be considered in determining the ordinary and customary meaning.” *ACTV, Inc. v. Walt Disney Co.*, 346 F.3d 1082, 1088 (Fed. Cir. 2003). Claims 1 and 14 further demonstrate a POSITA would understand an LED circuit in the ’341 Patent to have multiple voltage levels. Appx2754 [Bretschneider Decl], ¶46. Independent claims 1 and 14 each recite “switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit.” Appx0100-0101 [’341 Patent, claims 1 and 14]. Consistent with claims 3, 10 and 17, claims 1 and 14 already require at least two different voltages to an operating LED circuit. The Board’s construction to the contrary—requiring only a single voltage to the LED circuit—therefore directly contradicts claims 1 and 14 as well.

**c. The Board’s construction contradicts the specification of the ’341 Patent**

“There is a strong presumption against a claim construction that excludes a disclosed embodiment.” *Nobel Biocare Services AG v. Intradent USA, Inc.*, 903

F.3d 1365 (Fed. Cir. 2018) (*quoting In re Katz Interactive Call Processing Patent Litig.*, 639 F.3d 1303, 1324 (Fed. Cir. 2011)). The Board’s construction—which limits the claimed LED circuits to a single forward voltage—reads out numerous embodiments in the specification expressly disclosing multi-voltage circuits that provide multiple forward voltages to LED circuits. *See, e.g.*, Appx0096-0097 [’341 Patent, 3:12-19] (“This invention comprises circuits ... driven with more than one AC or DC forward voltage ‘multi-voltage’ ... based on a switching means that connects and/or disconnects at least one additional LED circuit to and/or from a first LED circuit”), 6:4-6 (“According to another aspect of the invention, a multi-voltage ... LED circuit...”), 6:47-51 (“multiple individual discrete LED chips are used to form at least one multivoltage ... LED circuit. ... Each multi-voltage ... LED circuit ... comprises at least two single voltage AC LED circuits.”); Appx2754-2755 [Bretschneider Decl, ¶¶47-48].

Indeed, interpreting two different forward voltages to be one fixed minimum voltage (per the Board’s construction) contradicts one of the stated advantages of the ’341 Patent, which is “to provide multiple voltage level ... LED circuits, chips, packages and lamps ... that can easily be electrically configured for at least two forward voltage drive levels ... .” Appx0096 [’341 Patent, 3:5-12]. *See, e.g.*, Appx0084, Appx0096-0097 [’341 Patent, Title, Abstract, 3:12-19, 4:38-45, 4:65-5:6, 5:44-51].

Numerous other embodiments support the fact that LED circuits in the '341 Patent can have multiple forward voltages. For example, the '341 Patent discloses embodiments where “each multi-voltage ... LED circuit ... comprises at least two single voltage AC LED circuits.” Appx0097 ['341 Patent, 6:47-51]. Similarly, the '341 Patent discloses embodiments where “a dimmer switch [ ] regulates voltage or ... integrated circuitry [ ] allows for adjustability of the otherwise relatively fixed voltage ... output of the LED circuit driver.” Appx0099 ['341 Patent, 9:17-24]. The output of an LED circuit driver is the input to the LED circuit. Appx3127 [Pet], 29 (“‘Driver’ is ... ‘circuitry that supplies an input to another circuit.’”). Thus, the dimmer switch or other integrated circuitry “adjust” the forward voltage provided to the LED circuit. Indeed, the express field of the invention “specifically relates to multiple voltage level ... light emitting diode circuits.” Appx0095 ['341 Patent, 1:41-46].

“One of the cardinal sins of patent law [is] reading a limitation from the written description into the claims.” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1320 (Fed. Cir. 2005) (citations and quotations omitted). The FWD violates this rule by arguing that the '341 Patent's use of “the term ‘forward voltage’ in connection with ‘single voltage series LED circuits’ ... support Petitioner's position that there is only one ‘forward voltage’ for an individual circuit.” Appx0026 [FWD]. Here, the Board improperly imports a narrowing embodiment from the specification to the exclusion

of multiple embodiments discussed in the preceding paragraphs that disclose providing multiple forward voltages to a single LED circuit. Indeed, the specification directly contradicts the Board’s conclusion, stating “ [t]his invention comprises circuits and devices that can be driven with more than one AC or DC forward voltage ‘multi-voltage’ ... .” Appx0096 [’341 Patent] 3:11-13]. The Board’s reliance on passages discussing single voltage LED circuits—which, as discussed above, can be combined with switches in parallel or series arrangements to form multi-voltage LED circuits—ignores the specification of the ’341 Patent.

Even in the non-limiting embodiments of the ’341 Patent that discuss a “single voltage” LED circuit, the ’341 Patent discusses that these two single voltage LED circuits may be combined to create a multi-voltage LED circuit. *See, e.g.*, Appx0096 [’341 Patent, 4:12-18] (“According to another aspect of the invention, each multi-voltage AC LED device would be driven with at least two different AC forward voltages resulting in a first forward voltage drive level by electrically connecting the two single voltage AC LED circuits in parallel and a second forward voltage drive level by electrically connecting the at least two single voltage AC LED circuits in series.”); 4:28-32 (“at least two single voltage series LED circuits, ... are formed ... providing a multi-voltage AC or DC operable LED device.”); 6:47-51 (“multiple individual discrete LED chips are used to form at least one multivoltage ... LED

circuit. ... Each multi-voltage ... LED circuit ... comprises at least two single voltage AC LED circuits.”).

The Board states “it is not apparent from the disclosure of the ’341 patent that brightness or light output levels of an LED device are changed based on adding or removing one or more individual circuit (i.e., the single voltage series LED circuit) with different forward voltages.” Appx0026 [FWD]. Here, the Board takes the position that an “LED circuit” must be a “single voltage series LED circuit.” This confuses the issue. As discussed above, “multi-voltage LED circuits” are disclosed in the specification of the ’341 Patent. These “multi-voltage LED circuits” are still “LED circuits” as required by the claims.

Further, the ’341 Patent teaches “single voltage LED circuits” are combined to form “multi-voltage LED circuits.” For example, the ’341 Patent teaches “switching on at least one additional single voltage AC LED circuit within multi-voltage and/or multi-current AC LED circuit to provide increased brightness from the LED lamp.” Appx0098 [’341 Patent, 7:3-8]. Thus, the ’341 Patent expressly teaches that adding additional LED circuits to a multi-voltage LED circuit “provides increased brightness.” And “each multi-voltage AC or DC LED device would be able to be driven with at least two different AC or DC forward voltages resulting in a first forward voltage drive level by electrically connecting the two single voltage series LED circuits in parallel and a second forward voltage drive level by

electrically connecting the at least two single voltage level series LED circuits in series.” Appx0096 [’341 Patent, 4:38-45].

Thus, the Board’s construction cannot be reconciled with the disclosure of the specification.

**d. The Board’s construction contradicts the extrinsic record**

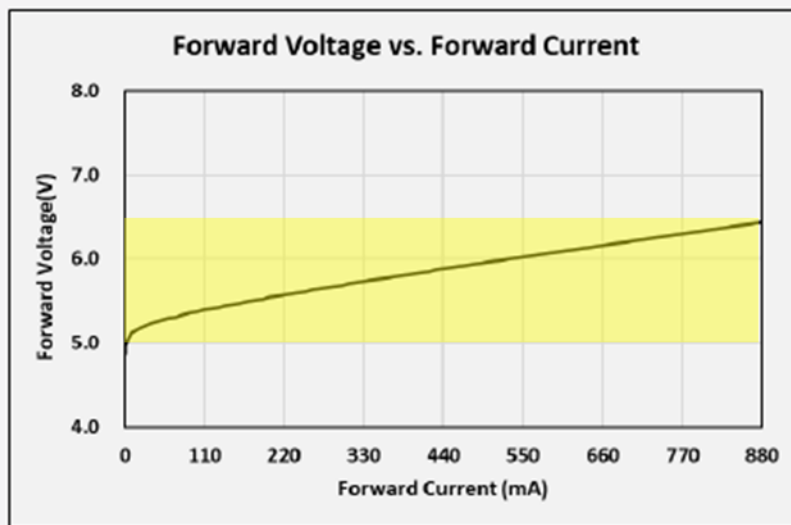
“[E]xtrinsic evidence in the form of expert testimony can be useful to a court ... to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field.” *Phillips*, 415 F.3d at 1318. The extrinsic record confirms the Board’s proposed construction is incorrect. Appx2755-2757 [Bretschneider Decl, ¶¶49-50]. Patent Owner’s expert, Dr. Bretschneider, explained that contemporaneous LED datasheets are clear that the type of commercially available LEDs that the ’341 Patent is directed to are not limited to a single minimum forward voltage. App2759-2763 [Bretschneider Decl, ¶¶57-62]. For example, Appx2948-2968 [Ex 2012 Samsung Datasheet] is a publicly available datasheet for a typical LED, Samsung High Power LED LH502C. Page 3 lists various electro-optical characteristics for the LED. Appx2950 [Ex 2012 Samsung Datasheet, 3]. One characteristic is “Forward Voltage  $V_F$ .” *Id.* As can be seen in the highlighted excerpt below, the datasheet lists a “Min.” (the minimum, 5.9V.), a “Typ.” (typical forward voltage, 6.1V), and a “Max.” (maximum forward voltage, 6.3V). Thus, the Samsung

datasheet recommends a range of forward voltages between 5.9 and 6.3V, not one single forward voltage and not just a minimum voltage.

b) Electro-optical Characteristics (  $I_f = 640 \text{ mA}$ ,  $T_j = 25^\circ\text{C}$  )

Item	Unit	Rank	Min.	Typ.	Max.
Forward Voltage ( $V_f$ )	V	YE	5.9	6.1	6.3

Similarly, page 10 of the datasheet displays various characteristic graphs for the LED. Appx2957 [Ex 2012, Samsung Datasheet, 10]. In the top left corner is a graph of forward voltage versus forward current. As can be seen from the highlighted portion of the graph below, current flows from a forward voltage of around 5V to around 6.5 V. Appx2957 [Ex 2012, Samsung Datasheet, 10]. Again, this demonstrates there is a range of potential forward voltages for the Samsung LED depending on the amount of current desired.

b) Forward Current Characteristics ( $T_j = 25^\circ\text{C}$ )

As another example, Appx2969-2972 [Ex. 2013 Cree Datasheet] is a publicly available datasheet for Cree MegaBright LEDs in the CxxxMB290-S0100 series. As shown in the highlighted portion of page 2 of the datasheet (below), the typical forward voltages for these LEDs can range from a minimum of 3.0V to a maximum of 3.8 or 4.0V. Appx2970 [Ex. 2013 Cree Datasheet, 2]. Once again, there is no single forward voltage associated with the LED.

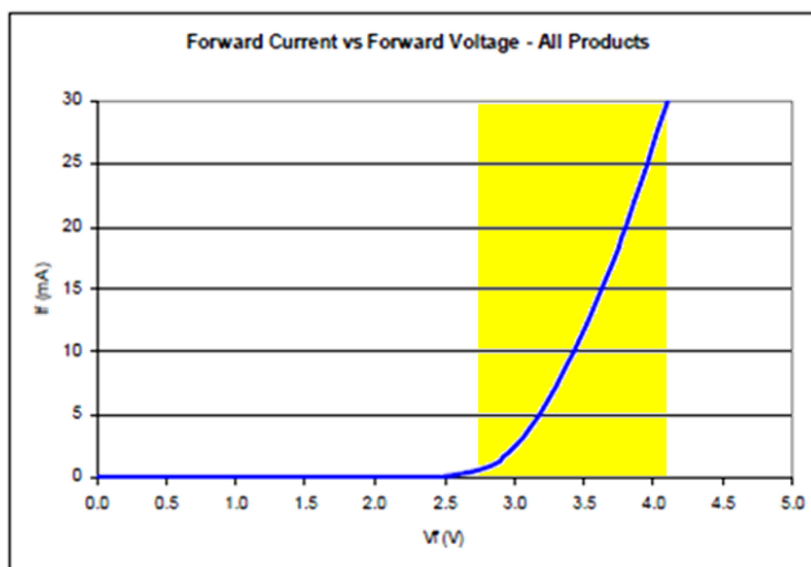
*Typical Electrical/Optical Characteristics at  $T_A = 25^\circ\text{C}$ ,  $I_f = 20\text{mA}$*  <sup>Note 3</sup>

Part Number	Forward Voltage ( $V_f$ , V)			Reverse Current [ $I_r$ ( $V_r=5\text{V}$ ), $\mu\text{A}$ ]	Peak Wavelength ( $\lambda_p$ , nm)	Full Width Half Max ( $\lambda_D$ , nm)	Optical Rise Time ( $\tau$ , ns)
	Min	Typ	Max	Max	Typ	Typ	Typ
C460MB290-S0100	3.0	3.5	3.8	10	458	26	30
C470 MB290-S0100	3.0	3.5	3.8	10	468	26	30
C505 MB290-S0100	3.0	3.8	4.0	10	502	30	30
C527 MB290-S0100	3.0	3.8	4.0	10	518	35	30

At page 4, the Cree datasheet also shows a characteristic curve of forward current versus forward voltage that is similar to the graph from the Samsung

datasheet (albeit with the axes switched.) Appx2972 [Ex. 2013 Cree Datasheet, 4]. As the Cree graph shows below (highlighted in yellow), these LEDs have a forward voltage range of about 3.0V to 4.0 or 4.5V depending on the desired amount of current. Appx2972 [Ex. 2013 Cree Datasheet, 4]. Again, the forward voltage is not limited to a single minimum voltage.

## Characteristic Curves



Thus, an LED's forward voltage is not limited to a single minimum forward voltage, as required by the Board's construction.

### iii. Petitioner's alternate construction is incorrect

The Petition also proposed an alternate construction for "forward voltage" of "a voltage in a diode's forward direction." Appx3124 [Pet.] 26]. Petitioner's

alternate construction is also incorrect because it allows for forward voltages that could be less than the minimum operating voltage and greater than the maximum operating voltage. In essence, Petitioner's alternate construction completely ignores the intrinsic record and the context in which "forward voltage" is used.

As discussed above, claims 3, 10 and 17 require the first LED circuit to be "operating." *See also* Appx0100-0101 [Ex. 1001 '341 Patent, claims 1, 7, 8, 14, 15] (also referring to "operating LED circuits."). The forward voltage cannot be *any* voltage because if the forward voltage is outside of the operating range of the LED circuit, the LED circuit will not provide light or will otherwise not operate. Similarly, as discussed above in §V.A.1, the specification is clear that the forward voltage "drives" the LED circuits. *See, e.g.,* Appx0096-0097 [Ex. 1001 '341 Patent, 3:5-11; 4:12-18; 4:18-27; 4:38-45; 5:27-34.] This means that the forward voltage applied to the LED circuit is within the appropriate range to allow the LED to illuminate as intended. Even the materials relied upon to support Petitioner's first proposed construction indicate that the forward voltage range is not just any voltage (as argued by Petitioner), but is specified by the particular LED(s) being used. *See, e.g.,* Appx2975-2976 [Bald Engineer, 3] ("forward voltage rated at 3.0 volts), 4 (showing a range of forward voltages between 1.8V and 2.2V). Thus, Petitioner's proposed alternative construction is also incorrect.

The forward voltage should therefore be construed as the operating voltage for the claimed LED circuit.

**D. THE '341 PATENT IS INELIGIBLE FOR POST GRANT REVIEW**

PGRs may only be filed against patents subject to the first inventor-to-file provisions of the AIA. *See* AIA § 6(f)(2)(A) (stating that the provisions of Section 6(d) “shall apply only to patents described in section 3(n)(1)”). Patents subject to the first-inventor-to-file provisions are those that issue from applications “that contain[] or contained at any time . . . a claim to a claimed invention that has an effective filing date as defined in section 100(i) of title 35, United States Code, that is on or after” March 16, 2013. AIA § 3(n)(1). “The moving party has the burden of proof to establish that it is entitled to the requested relief.” 37 C.F.R. § 42.20(c). Thus, Petitioner has the burden of establishing eligibility for post-grant review. *Trican Industries, Inc., v. Little Giant Ladder Systems, LLC*, PGR2021-00044, Paper 10, 14 (PTAB Aug. 3, 2021).

The Final Written Decision determined the '341 Patent is ineligible based entirely on its incorrect determination that claims 3, 4, 10, 11, 17, and 18 are impossible. First, the Final Written Decision held that claims 3, 10 and 17, and claims 4, 11, and 18 lack written description and enabling disclosure based entirely on its incorrect determination that these claims are impossible. Appx0051 [FWD]. Based on this determination, the Board held that “the effective filing date is, at best,

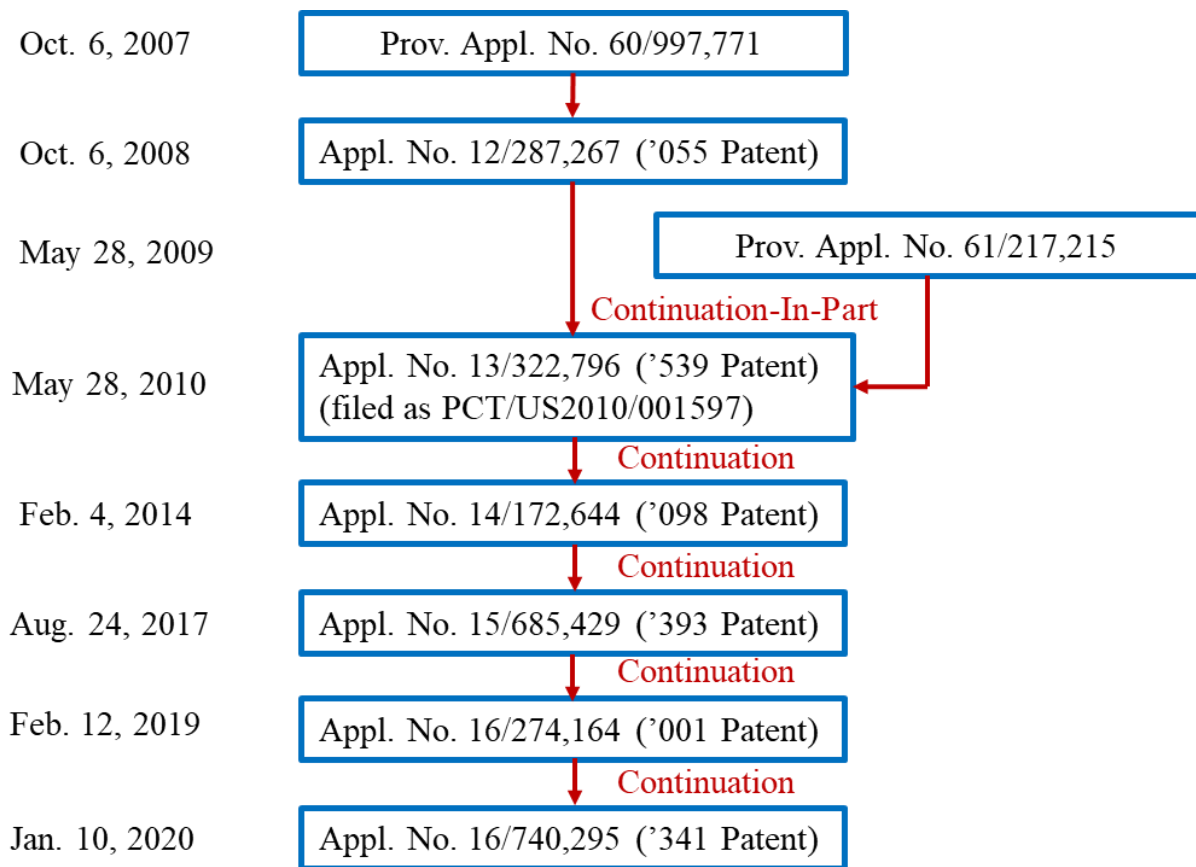
only as early as the filing date of the '295 application" (which issued as the '341 Application) filed on January 10, 2020. Appx0051 [FWD]. The Board then held that "PGR eligibility of the '341 Patent is conferred by the effective filing date of claims 3, 4, 10, 11, 17, and 18." Appx0052 [FWD].

Thus, the FWD collapses the analyses of (1) facial impossibility of claims, (2) § 112 support in the specification and (3) PGR eligibility into a single impossibility analysis. Appx0050-0051 [FWD].

With respect to (1) facial impossibility of the claims, as discussed above, claims 4, 11, and 18 are possible under any interpretation of the claims and claims 3, 10, and 17 are possible under the correct interpretation of the term "forward voltage." *See supra*, §§V.B, V.C.

With respect to (2), § 112 support, the as discussed above, the Board's finding of lack of written description, enablement and definiteness were based on its findings of impossibility. *See supra*, §§V.B, V.C. For claims 4, 11, and 18, the Board misstated the claim language to hold the claims impossible and therefore lacking in § 112 support. With respect to claims 3, 10, and 17, the Board's holding bootstrapped an impossibility finding based on its incorrect construction for "forward voltage." *Id.* Because the Board found claims 3, 4, 10, 11, 17, and 18 impossible, it reasoned they were also not supported in the written description, not enabled, and indefinite.

With respect to (3), PGR eligibility, there is no dispute that the disclosure in the specification of the '341 Patent is identical to the disclosure in pre-AIA applications. As illustrated below, the '341 Patent is a direct continuation of the pre-AIA '597 PCT, filed on May 28, 2010. Further, each application in the priority chain (and the corresponding patent) is also expressly incorporated by reference into the '341 Patent. *Id.*, Appx0095 [1:21-23] (“the contents of each of these applications are expressly incorporated herein by reference.”).



Thus, because claims 3, 4, 10, 11, 17, and 18 are supported by pre-AIA applications (in particular, the '597 PCT), the FWD did not establish the '341 Patent

is eligible for PGR. The Court should reverse the Board's decision on PGR eligibility.

### **CONCLUSION AND RELIEF SOUGHT**

For the reasons set forth above, the Board's decision and judgment should be reversed or vacated and remanded.

Date: October 30, 2023

Respectfully submitted,

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### **CERTIFICATE OF SERVICE**

I hereby certify that on the undersigned date, I caused this Brief of Appellant to be filed electronically with the Clerk of the Court using the CM/ECF System, which will send notice of such filing to the following registered CM/ECF users:

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/s/ Stephen P. McBride  
*Counsel for Appellant Lynk Labs, Inc.*

October 30, 2023

### **CERTIFICATE OF COMPLIANCE**

1. This brief complies with the type-volume limitation of Fed. R. App. P. 28.1(e)(2) or 32(a)(7)(B) because:

[ X ] this brief contains 10,623 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(a)(7)(B)(iii), or

2. This brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6) because:

[ X ] this brief has been prepared in a proportionally spaced typeface using [Microsoft Word] in [14pt Times New Roman]; or

Dated: October 30, 2023

Respectfully submitted,

/s/ Stephen P. McBride  
*Counsel for Appellant Lynk Labs, Inc.*

**ADDENDUM**

Final Written Decision (May 22 2023) ..... Appx0001

Ex. 1001 US Patent No. 10,932,341 (Feb 23 2021)..... Appx0084

Trials@uspto.gov  
571-272-7822

Paper 38  
Entered: May 22, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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HOME DEPOT U.S.A., INC.,  
Petitioner,

v.

LYNK LABS, INC.,  
Patent Owner.

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PGR2022-00009  
Patent 10,932,341 B2

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Before JON B. TORNQUIST, MONICA S. ULLAGADDI, and  
SCOTT RAEVSKY, *Administrative Patent Judges*.

ULLAGADDI, *Administrative Patent Judge*.

JUDGMENT  
Final Written Decision  
Determining All Challenged Claims Unpatentable

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## I. INTRODUCTION

Home Depot U.S.A., Inc. (“Petitioner”) filed a Petition (Paper 1, “Petition” or “Pet.”) requesting post-grant review of claims 1–5, 7–12, and 14–19 (“the challenged claims”) of U.S. Patent No. 10,932,341 B2 (Ex. 1001, “the ’341 patent”), accompanied by the supporting Declaration of Dr. Dean Neikirk (Ex. 1002). Lynk Labs, Inc. (“Patent Owner”) filed a Preliminary Response (Paper 5, “Preliminary Response” or “Prelim. Resp.”).

Upon review of these papers, we instituted post-grant review, pursuant to 35 U.S.C. § 324, as to the challenged claims based on the challenges set forth in the Petition. Paper 10 (“Institution Decision” or “Inst. Dec.”).

Subsequent to institution, Patent Owner filed a Patent Owner Response (Paper 20, “PO Resp.”), Petitioner filed a Reply to Patent Owner’s Response (Paper 29, “Pet. Reply”), and Patent Owner filed a Sur-Reply (Paper 30, “Sur-Reply”). On February 28, 2023, we held an oral hearing. A transcript of the hearing is of record. Paper 37 (“Tr.”).

For the reasons that follow, we conclude that Petitioner has proven by a preponderance of the evidence that the challenged claims of the ’341 patent are unpatentable.

## II. BACKGROUND

### A. *Real Parties in Interest*

Petitioner (i) identifies Home Depot Product Authority, LLC as a real party-in-interest, (ii) identifies The Home Depot, Inc. as a potential real party-in-interest because it is also a named defendant in a related litigation (discussed *infra*), and (iii) “[i]n an abundance of caution,” identifies as potential real parties-in-interest suppliers of certain products that have been

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accused in the litigation and from whom Petitioner has requested indemnification, including Bel Air Lighting, Inc., New Bright Technology, Cordelia Lighting, Elec-Tech Solid State Lighting (HK) Ltd., Globe Electric, King of Fans, Inc., Leedarson Lighting/Green Intelligence Co., and Year Young Industrial Co. Pet. 1. Petitioner notes that “[t]hese suppliers have not yet controlled or participated in the drafting of this Petition, and none has consented to being named an RPI.” *Id.*

Patent Owner identifies itself as the real party-in-interest. Paper 3, 1.

*B. Related Matters*

The parties identify: *Lynk Labs, Inc. v. The Home Depot USA, Inc., et al.*, No. 6:21-cv-00097 (W.D. Tex.) as a related matter involving the ’341 patent. Pet. 2; Paper 3, 1. Patent Owner also identifies *Lynk Labs, Inc. v. Home Depot USA, Inc. et al.*, No. 1:21-cv-05021 (N.D. Ga.) (“the Related Litigation”) and notes that the Georgia Litigation “was transferred from the Western District of Texas.” Paper 28, 1.

Patent Owner also identifies U.S. Patent Application Nos. 17/001,074, 17/157,264, 17/216,032, 17/266,505, and 17/306,450 as “pending applications [that] may affect, or be affected by, a decision in this proceeding.” Paper 3, 1.

Petitioner also challenges the ’341 patent, specifically, claims 1–3, 5, 7–10, 12, 14–17, and 19, in IPR2022-00143 and institution was denied on May 27, 2022.

Petitioner also challenges U.S. Patent No. 10,537,001, a parent of the ’341 patent, in IPR2021-01541, *inter partes* review was instituted on May 16, 2022, and a Final Written Decision finding all challenged claims unpatentable issued on April 26, 2023.

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*C. The '341 Patent*

The '341 patent issued from U.S. Application No. 16/740,295, filed on January 10, 2020 (“the '295 application”). Ex. 1001, codes (21), (22). The '295 application was filed as (i) a continuation of U.S. Application No. 16/274,164, filed on February 12, 2019, now U.S. Patent No. 10,537,001 (Ex. 1020, “the '001 patent”), and in turn is (ii) a continuation of U.S. Application No. 15/685,429, filed on August 24, 2017, now U.S. Patent No. 10,271,393, and in turn is (iii) a continuation of U.S. Application No. 14/172,644, filed on February 4, 2014, now U.S. Patent No. 9,750,098, and is in turn (iv) a continuation of U.S. Application No. 13/322,796, filed as Application No. PCT/US2010/001597 (Ex. 1018, “the '597 PCT”) on May 28, 2010, now U.S. Patent No. 8,648,539. Ex. 1001, code (63).

U.S. Patent No. 8,648,539 claims priority as a continuation-in-part of U.S. Application No. 12/287,267, filed on October 6, 2008, now U.S. Patent No. 8,179,055. *Id.* The '341 patent also claims the benefit of U.S. Provisional Application No. 61/217,215, filed on May 28, 2009, and U.S. Provisional Application No. 60/997,771, filed on October 6, 2007. *Id.* at code (60).

The '341 patent is titled “Multi-Voltage and Multi-Brightness LED Lighting Devices and Methods of Using Same” and “relates to light emitting diodes (‘LEDs’) for AC operation . . . [and] to multiple voltage level and multiple brightness level LED devices, packages and lamps.” *Id.* at code (54) (Title), 1:25–28.

The '341 patent explains that existing LED packages do not provide “a multi-voltage and/or multi-current circuit monolithically integrated on a

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single substrate.” *Id.* at 2:65–67. The ’341 patent provides that it would be advantageous to (i) have a multi-voltage and/or multi-brightness circuit that can “provide options in voltage level, brightness level and/or AC or DC powering input power preference,” and (ii) provide multiple voltage level and/or multiple brightness level light emitting LED circuits, chips, packages, and lamps “that can easily be electrically configured for at least two forward voltage drive levels with direct AC voltage coupling, bridge rectified AC voltage coupling or constant voltage DC power source coupling.” *Id.* at 3:1–12. To this end, the ’341 patent discloses an

invention [that] comprises circuits and devices that can be driven with more than one AC or DC forward voltage “multi-voltage” at 6V or greater based on a selectable desired operating voltage level that is achieved by electrically connecting the LED circuits in a series or parallel circuit configuration and/or more than one level of brightness “multi-brightness” based on a switching means that connects and/or disconnects at least one additional LED circuit to and/or from a first LED circuit. The desired operating voltage level and/or the desired brightness level electrical connection may be achieved and/or completed at the LED packaging level when the multi-voltage and/or multi-brightness circuits and/or single chips are integrated into the LED package, or the LED package may have external electrical contacts that match the integrated multi-voltage and/or multi-brightness circuits and/or single chips within, thus allowing the drive voltage level and/or the brightness level selectability to be passed on through to the exterior of the LED package and allowing the voltage level or brightness level to be selected at the LED package user, or the PCB assembly facility, or the end product manufacturer. . . .

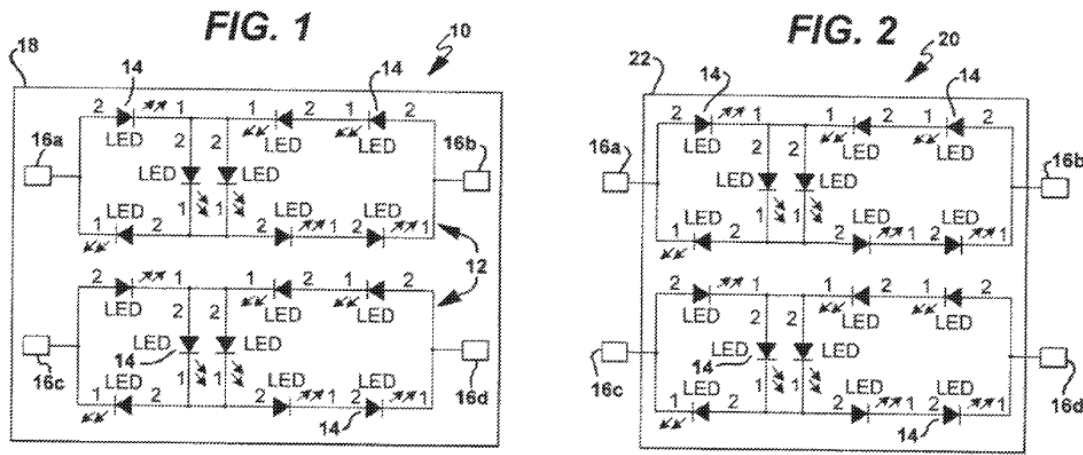
According to another aspect of the invention, each multi-voltage AC LED device would be able to be driven with at least two different AC forward voltages resulting in a first forward voltage drive level by electrically connecting the two single voltage AC LED circuits in parallel and a second forward voltage drive level

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by electrically connecting the at least two single voltage level AC LED circuits in series.

*Id.* at 3:12–32, 4:12–19.

Figures 1 and 2 of the '341 patent, illustrating schematic diagrams of multi-voltage and/or multi-brightness LED lighting devices, are reproduced below. *Id.* at 9:56–57, 10:12–13.



Figures 1 and 2 illustrate schematic diagrams of multi-voltage and/or multi-brightness LED lighting devices. *Id.* at 9:56–57, 10:12–13.

The multi-voltage and/or multi-brightness LED lighting device 10 illustrated in Figure 1 includes at least two AC LED circuits 12 configured in an imbalanced bridge circuit, each of which have at least two LEDs 14. *Id.* at 9:56–10:11. The at least two AC LED circuits have electrical contacts 16a, 16b, 16c, and 16d at opposing ends to provide connectivity options for an AC voltage source input. *Id.* For example, if 16a and 16c are electrically connected together and 16b and 16d are electrically connected together and one side of the AC voltage input is applied to 16a and 16c and the other side of the AC voltage input is applied to 16b and 16d, the circuit becomes a parallel circuit with a first operating forward voltage. *Id.* If, however, only 16a and 16e are electrically connected and the AC voltage inputs are applied

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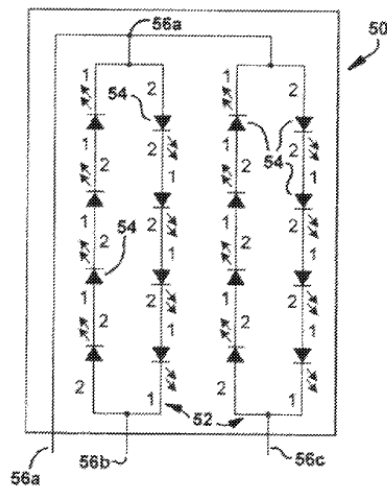
to electrical contacts 16b and 16d, a second operating forward voltage is required to drive the single chip 18. *Id.* The '341 patent further explains that single chip 18 may also be configured to operate at more than one brightness level, i.e., “multi-brightness,” by “electrically connecting for example 16a and 16b and applying one side of the line of an AC voltage source to 16a a[n]d 16b and individually applying the other side of the line from the AC voltage source a second voltage to 26b and 26c.” *Id.*

In the multi-voltage and/or multi-brightness LED lighting device 20 illustrated in Figure 2, the at least two AC LED circuits 12 are integrated onto substrate 22. *Id.* at 10:12–23. The at least two AC LED circuits 12 are configured in an imbalanced bridge circuit, each of which have at least two LEDs 14. *Id.* The at least two AC LED circuits have electrical contacts 16a, 16b, 16c, and 16d on the exterior of the substrate 22 and can be used “to electrically configure and/or control the operating voltage and/or brightness level of the multi-voltage and/or multi-brightness LED lighting device.” *Id.*

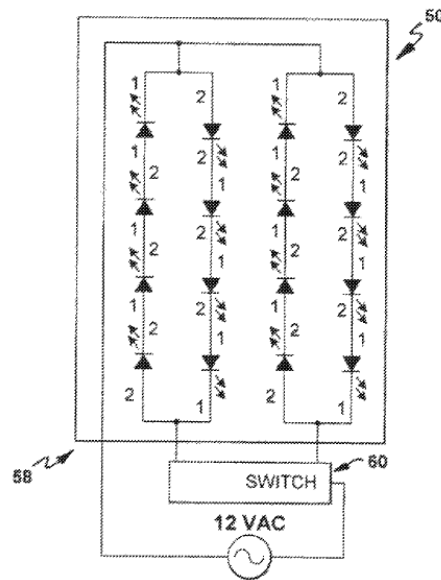
Figures 6 and 7 of the '341 patent, illustrating more schematic diagrams of multi-voltage and/or multi-brightness LED lighting devices, are reproduced below. *Id.* at 10:65–66, 11:18–19.

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**FIG. 6**



**FIG. 7**



Figures 6 and 7 illustrate schematic diagrams of multi-voltage and/or multi-brightness LED lighting devices. *Id.* at 10:65–66, 11:18–19.

The multi-voltage and/or multi-brightness LED lighting device 50 illustrated in Figure 6 includes at least two AC LED circuits 52, each of which have at least two LEDs 54 in series and anti-parallel relation. *Id.* at 10:65–11:17. The at least two AC LED circuits 52 have at least three electrical contacts 56a, 56b and 56c, and are electrically connected together in parallel at one end 56a and left unconnected at the opposing ends of the electrical contacts 56b and 56c. *Id.* One side of an AC voltage source line is electrically connected to 56a and the other side of an AC voltage source line is individually electrically connected to 56b and 56c “with either a fixed connection or a switched connection thereby providing a first brightness when AC voltage is applied to 56a and 56b and a second brightness when an AC voltage is applied to 56a, 56b and 56c.” *Id.* The multi-voltage and/or multi-brightness LED device shown in Figure 7, which is similar to the device shown in Figure 6, is further integrated within a lamp 58 and

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connected to a switch 60 to control the brightness level of the multi-voltage and/or multi-brightness LED lighting device. *Id.* at 11:18–22.

Figure 9 of the '341 patent, reproduced below, illustrates another schematic diagram of a multi-brightness LED lighting device. *Id.* at 11:40–43.

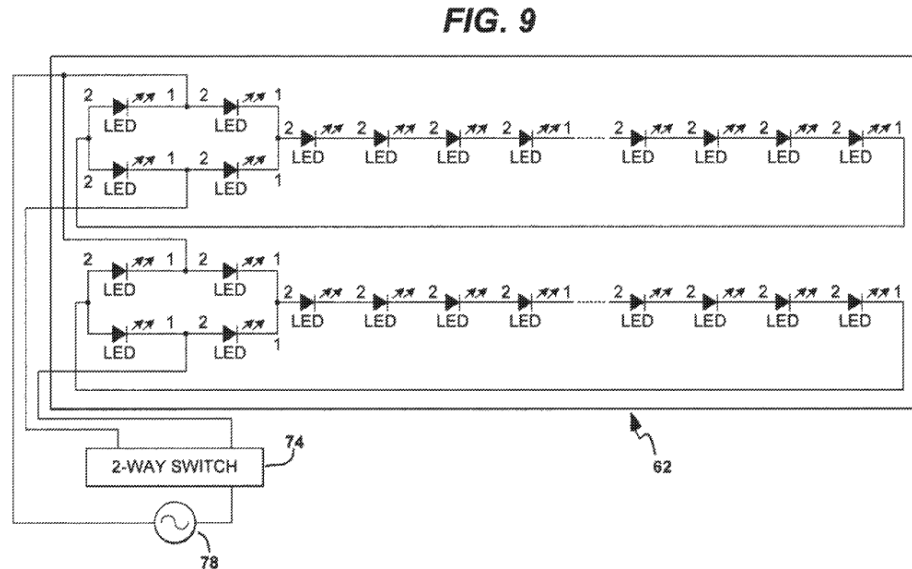


Figure 9 illustrates another schematic diagram of a multi-voltage and/or multi-brightness LED device including at least two single voltage LED circuits integrated with a single chip or within a substrate. *Id.* at 11:36–42.

The device illustrated in Figure 9 includes: two sets of four LEDs, each set configured in a bridge circuit; two bridge-rectified series LED circuits having plural LEDs connected in series; and a switch 74 electrically connected between the multi-brightness LED lighting device 62 and an AC voltage source 78, to enable a change in the brightness level of the multi-brightness LED lighting device. *Id.* at 11:23–43.<sup>1</sup>

<sup>1</sup> We refer to the description of Figure 8 with respect to Figure 9 because the description of Figure 9 references the description of Figure 8.

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#### *D. Illustrative Claims*

Petitioner challenges claims 1–5, 7–12, and 14–19 of the '341 patent. Pet. 1. Claims 1, 8, and 15 are independent. Claim 1 is illustrative and reproduced below.

1. [1.pre] An LED lighting device comprising:
  - [1.a] a first operating LED circuit and at least one additional LED circuit,
  - [1.b] at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and
  - [1.c] the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and
  - [1.d] a switch capable of at least one of:
    - (a) switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit, or
    - (b) switching the at least one additional LED circuit on or off,
  - [1.e] wherein (a) or (b) is selectable by a user switching the switch, and
  - [1.f] wherein the LED lighting device is configured to connect to an AC voltage power source.

Ex. 1001, 12:9–27.<sup>2</sup>

#### *E. Asserted Grounds*

Petitioner presents the following challenges as summarized in the chart below. Pet. 5.

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	3, 10, 17	112(a), 112(b) <sup>3</sup>	Lack of Written Description; Lack of Enablement;

<sup>2</sup> Bracketed reference numbering/lettering reflects Petitioner's annotations.

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Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
			Indefiniteness
2	4, 11, 18	112(a), 112(b)	Lack of Written Description; Lack of Enablement; Indefiniteness
3	1, 3, 5, 7, 8, 10, 12, 14, 15, 17, 19	102 <sup>4</sup>	Bruning <sup>5</sup>
4	1–3, 5, 7–10, 12, 14–17, 19	103 <sup>4</sup>	Bruning, Kabel <sup>6</sup>
5	1, 2, 5, 7–9, 12, 14–	103	Dowling, <sup>7</sup> Mueller <sup>8</sup>

<sup>4</sup> Per the Manual of Patent Examining Procedure (MPEP) § 2159.02, America Invents Act (“AIA”) 35 U.S.C. §§ 102, 103 took effect on March 16, 2013. AIA 35 U.S.C. §§ 102, 103 apply to any patent application that contains or contained at any time a claim to a claimed invention that has an effective filing date that is on or after March 16, 2013. If a patent application (1) contains or contained at any time a claim to a claimed invention having an effective filing date as defined in 35 U.S.C. § 100(i) that is on or after March 16, 2013 or (2) claims or ever claimed the benefit of an earlier filing date under 35 U.S.C. §§ 120, 121, or 365 based upon an earlier application that ever contained such a claim, then AIA 35 U.S.C. §§ 102, 103 apply to the application, (i.e., the application is an AIA application). If there is ever even a single claim to a claimed invention in the application having an effective filing date on or after March 16, 2013, AIA 35 U.S.C. §§ 102, 103 apply in determining the patentability of every claimed invention in the application. This is the situation even if the remaining claimed inventions all have an effective filing date before March 16, 2013, and even if a claim to a claimed invention having an effective filing date on or after March 16, 2013, is canceled. *Infra* §§ III.A.2–3 (determining that at least one claim in the ’341 patent has an effective filing date after March 16, 2013 **and implicating AIA versions of the statutes for each challenged ground**).

<sup>5</sup> U.S. Patent Application Publication No. 2002/0070914 A1, published June 13, 2002 (Ex. 1004, “Bruning”).

<sup>6</sup> U.S. Patent Application Publication No. 2004/0164948 A1, published August 26, 2004 (Ex. 1005, “Kabel”).

<sup>7</sup> U.S. Patent Application Publication No. 2002/0048169 A1, published April 25, 2002 (Ex. 1006, “Dowling”).

<sup>8</sup> U.S. Patent No. 6,016,038, issued January 18, 2000 (Ex. 1007, “Mueller”).

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Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
	16, 19		

### III. ANALYSIS

#### A. *Legal Standards*

“The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same.” 35 U.S.C. § 112(a). The Federal Circuit “has consistently held that § 112, first paragraph<sup>9</sup>, contains a written description requirement separate from enablement.” *Ariad Pharm. v. Eli Lilly and Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). “[T]he test for sufficiency [of the written description] is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.” *Id.*

“To prove that a claim is invalid for lack of enablement, a challenger must show . . . that a person of ordinary skill in the art would not be able to practice the claimed invention without undue experimentation.” *Enzo Life Sciences, Inc. v. Roche Molecular Systems, Inc.*, 928 F.3d 1340, 1345 (Fed. Cir. 2019). Factors to be considered in determining whether a disclosure would require undue experimentation include:

(1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of

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<sup>9</sup> The AIA recodified 35 U.S.C. § 112, first paragraph, as 35 U.S.C. § 112(a). Pub. L. No. 112-29, 125 Stat. at 296–97.

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the claims.

*In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988).

In this post-grant review proceeding, we apply the test for indefiniteness approved by the Supreme Court in *Nautilus, Inc. v. Biosig Instruments, Inc.*, 572 U.S. 898 (2014). See Memorandum on Approach to Indefiniteness Under 35 U.S.C. § 112 in AIA Post-Grant Proceedings (Jan. 6, 2021), 5 (“The office now clarifies that the Board shall follow *Nautilus* in AIA post-grant proceedings”).<sup>10</sup> Under *Nautilus*, a claim of a patent challenged for indefiniteness is unpatentable if the claim, read in light of the patent specification and the prosecution history, fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. *Nautilus*, 572 U.S. at 901.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros., Inc. v. Union Oil Co. of*, 814 F.2d 628, 631 (Fed. Cir. 1987).

A patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art;

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<sup>10</sup> Available at <https://www.uspto.gov/sites/default/files/documents/IndefinitenessMemo.pdf>.

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(3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness.<sup>11</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

In a post-grant review, as in an *inter partes* review, “the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *See Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). This burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware*, 800 F.3d at 1378.

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

#### *B. Level of Ordinary Skill in the Art*

Petitioner contends that:

A person of ordinary skill in the art (“POSITA”) as of October 6, 2007 (earliest listed priority date) or January 10, 2020 (actual filing date), would have had a bachelor’s degree in electrical engineering, or similar technical field, with two years of relevant experience in the field of design and/or development of LEDs and circuits in the context of lighting control systems. An increase in experience could compensate for less education.

Pet. 24 (citing Ex. 1002 ¶ 46).

Patent Owner contends that

the ’341 Patent is directed toward lighting devices. Thus, the proper field is “the field of design and/or development of LEDs and circuits in the context of **lighting devices**,” not “**lighting control systems**.” Indeed, as seen in ’341 Patent, Figs. 1-12, the disclosure is directed to devices such as LED packages and lamps, not the control systems that can be used to control LEDs. So, for example, the ’341 Patent is directed to devices like LED

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<sup>11</sup> Patent Owner does not present objective evidence of nonobviousness.

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chips, bulbs, or lamps, not multicomponent lighting control systems.

PO Resp. 4–5 (citing PO Resp. § II.A; Ex. 1001, 1:26–29 (“The present invention specifically relates to multiple voltage level and multiple brightness level LED devices, packages and lamps.”), 1:41–46 (“The present invention specifically relates to multiple voltage level and multiple brightness level light emitting diode circuits, single chips, packages and lamps ‘devices.’”); Ex. 2008 ¶ 40 (Bretschneider Decl.)).

Each of the challenged claims of the ’341 patent recites an “LED lighting device.” Accordingly, we determine that the level of ordinary skill in the art is “a bachelor’s degree in electrical engineering, or similar technical field, with two years of relevant experience in the field of design and/or development of LEDs and circuits,” as Petitioner proposes and that “the field of design and/or development” would be “in the context of lighting devices” as Patent Owner proposes, in which “[a]n increase in experience could compensate for less education.” *Id.*; Pet. 24 (citing Ex. 1002 ¶ 46).

Our definition is consistent with the specification of the ’341 patent and the cited references. The findings and conclusions rendered in this Decision would not change had we adopted Petitioner’s definition in its entirety.

### *C. Claim Construction*

In this post-grant review, filed on November 12, 2021, we construe the claims of the ’341 patent using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b) (2021), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of

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ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.200(b); *see Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–1314 (Fed. Cir. 2005) (en banc). In construing claims in accordance with their ordinary and customary meaning, we take into account the specification and prosecution history. *Phillips*, 415 F.3d at 1315–17.

Petitioner sets forth proposed constructions for the terms “forward voltage,” “switch,” “selectable by a user switching the switch,” and “driver.” Pet. 24–29. According to Petitioner, “[b]ecause the prior art asserted herein discloses the preferred embodiment within the indisputable scope of the claims, the Board need not construe the outer bounds of the claims as part of these proceedings.” *Id.* at 24.

In the present proceeding, we need only construe “forward voltage” in order to decide Petitioner’s challenges. We do not need to expressly construe any of the other claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”)).

1. *Petitioner’s Proposed Constructions of “Forward Voltage”*

Petitioner asserts “[f]orward voltage” should be construed as “the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs” based on the [Patent Owner’s] express definition in the intrinsic record.” Pet. 25. Petitioner represents that Patent Owner, in the Related Litigation, asserted that this “express definition” should not be applied. *Id.* at 26 (citing

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Ex. 1022, 35–38).<sup>12</sup> Petitioner urges that, “[i]n the alternative, ‘forward voltage’ should be construed as ‘a voltage in a diode’s forward direction.’” *Id.* at 25–26.

## 2. *Petitioner’s Initial Claim Construction Contentions*

Petitioner contends that during prosecution of U.S. Application No. 16/274,164 (the application underlying the parent of the ’341 patent, the ’001 patent, “the ’164 application”), Patent Owner expressly defined “forward voltage.” Pet. 25 (citing Ex. 1023, 9 (Amendment)). During prosecution of the ’164 application, Applicant asserted that:

Colby<sup>[13]</sup> fails to disclose that the first operating LED circuit and the at least one additional LED circuit both have a forward voltage of 6V or greater [as amended]. Stating that “US plugs operate on 120V 60Hz,” the Office Action essentially relies on the disclosure of ‘AC voltage’ in Colby having a ‘frequency of 60 Hz’ as disclosing the forward voltage required by claim 1. *Office Action*, p. 4; *Colby*, 4:26–31. However, Applicant respectfully submits that the disclosure of an AC voltage supplied from a wall outlet does not disclose the forward voltage of an LED.

“the forward voltage” of an LED circuit, as recited in claim 1, is the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.” (*See, e.g., LED Tutorial - Learn the basics*, <https://www.baldengineer.com/led-basics.html>.) Thus; the recited forward voltage is different from the AC voltage provided by a typical wall outlet.

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<sup>12</sup> In the Related Litigation, we note that Patent Owner states that “[t]he passage from the prosecution history referencing the ‘Bald Engineer’ [webpage] is generally consistent with the plain and ordinary meaning in the context of the claims under the discussion in the ’001 patent” and “[t]hus, the term requires no further construction.” Ex. 1022, 36 (referring to definition at <https://www.baldengineer.com/led-basics.html>).

<sup>13</sup> U.S. Patent No. 7,748,877 B1 to Colby (Ex. 1037, “Colby”).

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Ex. 1023, 9 (citing Ex. 2014, “Bald Engineer LED Tutorial”).

### 3. *Patent Owner’s Response and Sur-reply*

*First*, Patent Owner argues that limiting “forward voltage” to a single minimum voltage would be inconsistent with the two forward voltages recited in dependent claims 3, 10, and 17, is “contrary to the central purpose of the ’341 Patent, which is to provide multiple voltage levels and multiple brightness levels to LED circuits,” and “would exclude numerous embodiments of the ’341 Patent discussed above, including the embodiment covering the stated purpose of the patent.” PO Resp. 11–13; *see* Sur-reply 11–12, 22.

*Second*, Patent Owner further argues that “[t]he Petition does not attempt to argue that the statement in the prosecution history for the ’001 Patent is a clear and unmistakable disavowal of the explicit teachings of the claims and specification of the ’341 Patent,” and the “Petition cannot do so because the statement is from the file history for another patent discussing different claim language in a context that is different than the construction proposed here.” PO Resp. 19; *see* Sur-reply 6–7, 9–10 (Patent Owner characterizing Applicant as arguing, during prosecution, that “one could not simply use AC mains . . . as the forward voltage for LEDs because the forward voltage is a function of the operating characteristics of the LED circuits,” and “[t]hus, the applicant did not define forward voltage as one specific minimum voltage”). According to Patent Owner,

the claim language being addressed in the ’001 Application (“forward voltage of 6V or greater”) is different, the application under review (’164 Application) is different, and the prior art being addressed (the Colby reference) is not at issue here. Taken together, it is very *unclear* how the statement applies in the context of the ’341 Patent. What is clear is that Petitioner’s

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position is expressly and repeatedly contradicted by the plain language of the claims and specification of the '341 Patent. Thus, adopting Petitioner's proposed construction would be clear legal error.

PO Resp. 19–20.

*Third*, Patent Owner contends that

“[t]he minimum voltage difference required” does not rule out, and in fact implies the potential use of voltages in excess of that minimum. This interpretation is supported by the language of the claim being discussed (“a forward voltage of 6V or greater”), which clarifies that a forward voltage can have values equal to or greater than the minimum voltage (there, 6V) to allow current to flow.

This interpretation is also supported by the website that the Applicant cited ([www.baldengineer.com/led-basics.html](http://www.baldengineer.com/led-basics.html)) in support of its statement. Ex. 2014 [Bald Engineer]. The website states that “[t]he ‘Forward Voltage’ rating of a diode will determine the minimum voltage difference between the anode and cathode to allow current to flow.” Read carefully, the website is drawing a distinction between forward voltage and minimum voltage—the forward voltage rating determines the minimum voltage, but is not necessarily limited to that minimum voltage. Further in the discussion, the website cites to data sheets showing that yellow LEDs have a forward voltage operating range, including a minimum and maximum voltage.

*Id.* at 22 (citing Ex. 2008 ¶¶ 69, 71) (alteration in original); *see* Sur-reply 2 (citing PO Resp. 16–17; Pet. Reply 6, 9), 10. Patent Owner presents a portion of the Bald Engineer LED Tutorial, reproduced below, that shows a minimum and maximum value of a forward voltage for a particular LED.

Items	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	I <sub>F</sub> =20mA	1.8	---	2.2	V

Table Reproduced from Bald Engineer Tutorial  
Describing Forward Voltage of an LED. Ex. 2014.

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Patent Owner also argues that “Petitioner’s second proposed construction (‘a voltage in a diode’s forward direction’) is also incorrect because it allows for forward voltages that could be less than the minimum operating voltage and greater than the maximum operating voltage.” PO Resp. 23.

4. *Patent Owner’s Proposed Construction of “Forward Voltage”*

Disputing Petitioner’s proposed constructions, Patent Owner contends that “a POSITA would understand that the term ‘forward voltage’ in the ’341 Patent should be construed as the operating voltage for the claimed LED circuit.” PO Resp. 11. Patent Owner further contends its

construction uses the term “operating” voltage for the LED circuit to clarify that the claim requires voltage in a range that will actually cause the LED circuit to “operat[e]”—that is, illuminate in the manner intended. If the forward voltage were zero, below the minimum turn on voltage the LED circuit would not provide light and would not be an “operating LED circuit.”

*Id.* at 7 (alteration in original). According to Patent Owner,

[i]f the forward voltage were above the maximum operating voltage for that particular LED circuit, a number of undesirable effects would occur, including possible LED failure, a shorter LED life, a shift away from the intended color or intensity, and/or excessive heat generation. Under any of these conditions, the LED circuit would not operate as intended.

*Id.* at 7–8 (citing Ex. 2008 ¶ 46).

Patent Owner cites numerous portions of the specification in support of its position. *Id.* at 8 (citing Ex. 1001, code (54) (Title), code (57) (Abstract), 1:25–28, 1:41–46, 3:12–14, 4:33–35, 4:38–41, 5:27–34); *see id.* at 9 (citing Ex. 2008 ¶ 48). The cited portions of the specification disclose “multi-voltage and multi-brightness LED lighting devices” as well as that “the forward voltage ‘drives’ the LED circuit.” *Id.*

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Patent Owner also cites extrinsic evidence. *Id.* at 8–10 (citing Ex. 2011 (“All About Circuits”); Ex. 2008 ¶¶ 49, 50), 14 (citing Ex. 2012 (“Samsung Datasheet”)), 16 (citing Ex. 2013 (“Cree Datasheet”)). In particular, Patent Owner cites manufacturer specification sheets for particular makes of diodes and argues that within “even a single diode, the forward voltage will vary depending on the current applied.” *Id.* at 10. Patent Owner explains that

[a] basic property of diodes is that they have a range of forward voltages that may be applied for the diode to operate and are not limited to a single minimum voltage. For example, one electrical engineering textbook discloses that “[t]he voltage dropped across a conducting, forward-biased diode is called the forward voltage.” Ex. 2011 [All About Circuits] explains that forward voltage “varies only slightly for changes in forward current and temperature” and provides a graph showing the relationship. As can be seen in the graph below, the forward voltage (labelled “Forward Bias”) for this particular diode varies from a minimum of about .5V to a maximum of about .9V depending on the current applied.

*Id.* at 9 (citing Ex. 2008 ¶ 49) (second alteration in original).

### 5. *Petitioner’s Reply*

With respect to Patent Owner’s *first* argument, Petitioner responds that “the fact that the ‘operating’ LED circuit limitation may further limit the voltages required to practice the claim as a whole does not mean that it should be read into other limitations” particularly when “the ‘forward voltage’ limitation is applied in the alternative to the ‘additional’ LED circuit, which lacks the ‘operating’ limitation.” Pet. Reply 3–4.

With respect to Patent Owner’s *second* argument, Petitioner characterizes Patent Owner as “assert[ing] a definition or disclaimer related to a claim term in a parent patent cannot be used against the child patent.”

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*Id.* at 7 (citing PO Resp. 18–19). Petitioner argues that Patent Owner “again attempts to distance its definition of ‘forward voltage’ in the parent’s prosecution history from the use of the exact same term in the claims of the 341 patent” and argues that “there is no basis in fact or law to ignore the definition.” *Id.* at 8 (citing PO Resp. 21–22); *see id.* at 7 (citing *Cordis Corp. v. Boston Scientific Corp.*, 658 F.3d 1347, 1356 n.5 (Fed. Cir. 2011)).

With respect to Patent Owner’s *third* argument, Petitioner contends that the Bald Engineer LED Tutorial “is explicit that the ‘forward voltage’ is a single, minimum voltage.” *Id.* at 8 (citing Ex. 2014, 2 (“minimum voltage difference,” “The forward voltage defines the amount of voltage required for the current to flow through the diode junction. Any voltages below this level cause the LED to remain ‘open’ or non-conductive.”)). Petitioner contends that the Bald Engineer LED Tutorial “does mention an LED datasheet as an example, but that datasheet . . . , merely shows minor variances in the single forward voltage that is possible based on either manufacturing tolerances or operating conductions<sup>[14]</sup>.” *Id.* at 9 (citing Ex. 1034 ¶¶ 16–17).

Petitioner similarly contends that Exhibits 2011, 2012, and 2013 are LED data sheets “which show relatively minor variations in purported ‘forward voltages’ based on manufacturing tolerances and operating conditions.” *Id.* at 6 (citing PO Resp. 13–18). Petitioner persuasively points out that, “[o]n cross examination, [Patent Owner’s] expert admitted that those minor variations were based on operating conditions, *and that at constant temperature and current there would be single forward voltage.*”

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<sup>14</sup> In its Petitioner’s Reply, Petitioner uses the term “operating conductions.” We presume the Petitioner intends to refer to “operating conditions” as set forth in Dr. Neikirk’s Reply Declaration (Ex. 1034 ¶ 16).

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*Id.* (citing Ex. 1035, 61:1–9, 61:21–62:3) (emphasis added). Petitioner further persuasively contends that “these minor variations are inconsistent with [Patent Owner’s] theories regarding the disclosure of multiple forward voltages in the specification” because “[Patent Owner’s] (incorrect) theory is that the switch could change the forward voltage by *cutting it in half or doubling it, by changing the parallel/serial configuration of the LED circuits.*” *Id.* (emphasis added). According to Petitioner,

with respect to EX2012, a particular Samsung LED device would have a forward operating voltage somewhere between 5.9V and 6.1V. PO’s expert admitted that for such a device, neither [halving the voltage to] 3V nor [doubling the voltage to] 12V would be a forward voltage because the LED would not operate at 3V and would be destroyed at 12V. Thus, this extrinsic evidence exposes an additional flaw in PO’s analysis of the intrinsic record.

*Id.* at 6–7 (citing Ex. 1035, 63:1–64:5, 65:5–21, 62:9–17).

## 6. Analysis

Having reviewed the entire record developed during trial, we are persuaded that Petitioner’s claim construction position is supported by evidence, and we maintain our preliminary construction of “forward voltage.” Patent Owner’s arguments are unavailing as they urge us to ignore the intrinsic evidence (e.g., prosecution history disclaimer) in favor of extrinsic evidence (e.g., diode manufacturing specification data sheets).

The intrinsic record—including the disclosures in the ’341 patent and the disclaimer made during prosecution of the application underlying the ’001 parent patent—persuades us that Petitioner’s first construction, “the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs” is supported by the record.

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As we explained in our Institution Decision, one exception to the general rule that claim terms are given their ordinary and customary meaning is “when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Uship Intellectual Props., LLC v. United States*, 714 F.3d 1311, 1313 (Fed. Cir. 2013) (quoting *Thorner v. Sony Computer Entm’t Am., LLC*, 669 F.3d 136s2, 1365 (Fed. Cir. 2012)). During prosecution, Applicant “ma[de] clear that the invention does not include a particular feature”—that is, made clear that the claimed “forward voltage of 6V *or greater*” excludes a 120V AC voltage from a wall outlet. *GE Lighting Solutions, LLC v. AgiLight, Inc.*, 750 F.3d 1304, 1309 (Fed. Cir. 2014) (quoting *SciMed Life Sys. Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1341 (Fed. Cir. 2001)) (disavowal requires that “the specification [or prosecution history] make[] clear that the invention does not include a particular feature”).

As the ’001 patent is the parent to the ’341 patent, we consider arguments made during the prosecution of the application underlying the ’001 patent relevant to determining how “forward voltage” should be construed in the child patent, the ’341 patent. Patent Owner cites no authority that would support disregarding the statements in the ’001 patent for any reason, including because the ’001 patent is a parent patent, the claim term “forward voltage” is used differently in the claim (i.e., claim 1 of the ’001 patent recites “forward voltage *of 6V or greater*”), or that the statements made during prosecution were used to distinguish a different reference, Colby.

We agree with Petitioner that “there is no basis in fact or law to ignore the definition.” Pet. Reply 8 (citing PO Resp. 21–22); *see id.* at 7 (citing

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*Cordis Corp. v. Boston Scientific Corp.*, 658 F.3d 1347, 1356 n.5 (Fed. Cir. 2011) (“Arguments made in the course of prosecuting the [parent] application are relevant, however, because a disclaimer in the parent application carries forward into the construction of the same claim term in the child.”). Patent Owner’s “recharacteriz[ation] [of] its disclaimer over Colby as merely related to wall outlets” is unavailing. *Id.* (citing PO Resp. 19–21). When a claim is not ambiguous, we do not read limitations into the claim to preserve its validity. *See Bennett Regul. Guards, Inc. v. Atlanta Gas Light Co.*, 825 F. App’x 773, 777 (Fed. Cir. 2020) (“Claims are construed to preserve validity only if, ‘after applying all the available tools of claim construction . . . the claim is still ambiguous.’”).

Even though, when read in isolation, 120V AC voltage might theoretically fall under the “or greater” portion of the amended claim limitation “forward voltage of 6V or greater,” Applicant distinguished Colby on the basis that the 120V AC voltage from a wall outlet is not “*the minimum voltage* difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.” *See* Ex. 1023, 9 (emphasis added). Applicant’s argument specifically identifies the claim language at issue—“forward voltage of 6V or greater”—and specifically states that it is not disclosed because Colby does not disclose *the minimum voltage* and *instead*, discloses something else, something larger—120V AC voltage. Accordingly, we conclude that Applicant disclaimed any voltage that is more than “the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs” from the scope of “forward voltage.”

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We also agree with Petitioner that the '341 patent repeatedly uses the term “forward voltage” in connection with “single voltage series LED circuits.” *See* Pet. 25 (citing Ex. 1001, 4:5–7:8; Ex. 1021, 28–30; Ex. 1002 ¶ 47). These disclosures support Petitioner’s position that there is only one “forward voltage” for an *individual* circuit (i.e., a single voltage series LED circuit). In contrast, the forward voltage may differ based on the connection type, i.e., parallel or series, between at least *two* circuits. *See, e.g.*, Ex. 1001, 4:12–27. It is not apparent from the disclosure of the '341 patent that brightness or light output levels of an LED device are changed based on driving an individual circuit (i.e., the single voltage series LED circuit) with different forward voltages. *See generally id.* Instead, it appears that brightness levels or light output levels change based on adding or removing one or more individual circuits connected in series or parallel to a “first operating LED circuit.” *Id.* at 3:45–49 (“It would further be advantageous to provide multi-brightness LED devices that can be switched to different levels of brightness by simply switching *additional circuits on or off in addition* to a first operating circuit within a single chip and or LED package.” (emphasis added)).

*D. Challenge 1—Lack of Written Description and Enablement, and Indefiniteness of Claims 3, 10, and 17*

Petitioner contends claims 3, 10, and 17 are invalid because they lack written description and enablement under 35 U.S.C. § 112(a) and because they are indefinite under 35 U.S.C. § 112(b). Pet. 29–32.

*1. Petitioner’s Initial Contentions*

*First*, Petitioner contends that, “[u]nder any construction of ‘forward voltage,’ such as the alternative construction, claims 3, 10 and 17 are not supported by the specification as filed.” Pet. 31 (citing Ex. 1002 ¶ 59).

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Petitioner contends that this is because, “none of these embodiments includes a switch, wherein switching the switch provides two different DC forward voltages to an LED circuit.” *Id.* at 32 (citing Ex. 1002 ¶ 64); *see id.* at 31–32 (citing Pet. §§ V.A, V.C.1.a; Ex. 1002 ¶¶ 59–64).

*Second*, Petitioner contends that “[u]nder the correct construction of ‘forward voltage,’ each of the ‘first operating LED circuit’ and the ‘one additional LED circuit’ has a single ‘forward voltage’ because each has a single ‘minimum.’” *Id.* at 30 (citing Pet. § V.E.2). According to Petitioner, “[b]ecause each circuit has only a single ‘forward voltage,’ no switch can provide ‘at least two different’ forward voltages to either circuit” and “[t]hus, under the correct construction of ‘forward voltage,’ these claims are to impossible subject matter that is not disclosed in the specification.” *Id.* (citing Ex. 1002 ¶ 57). We refer to these arguments as Petitioner’s “impossibility of multiple minimum voltages” arguments.

Petitioner contends that, “because the specification does not describe or enable this impossible subject matter, the claims are invalid for lack of written description and lack of enablement.” *Id.* at 30–31. Petitioner also contends that “[a] claim to impossible subject matter is invalid as indefinite.” *Id.* Petitioner also takes the position that “[n]one of these embodiments disclose or enable the full breadth of these claims” because the claims encompass a situation in which the two different voltages are applied to only one of the LED circuits—under any construction of “forward

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voltage” as it appears in the claim term “two different DC forward voltages.” *Id.* at 19–20.

## 2. *Patent Owner’s Response and Sur-reply*

First, Patent Owner points to paragraphs 28 and 30 of the ’597 PCT, which disclose an LED device that is “driven with at least two different DC forward voltages,” including “a first forward voltage drive level when the two single voltage LED circuits *are connected in parallel* and a second forward voltage drive level that is twice the level of the first forward voltage drive level when the at least two LED circuits *are connected in series*.” Ex. 1018 ¶¶ 28 (emphases added), 30. Patent Owner takes the position that, “[b]ecause the claims provide different voltages to ‘at least one of’ the two circuits, they clearly allow for different voltages to one *or* both of the LED circuits.” PO Resp. 27 (emphasis added). According to Patent Owner, “the ’597 Application repeatedly and expressly discloses single multi-voltage LED circuits (that is, LED circuits that operate using more than one forward voltage).” *Id.* (citing Ex. 1018 ¶¶ 13 (“The art is deficient in that it does not provide a multi-voltage . . . circuit monolithically integrated on a single substrate”), 14 (“It would further be advantageous to have a multi-voltage . . . circuit that can provide options in voltage level, brightness level and/or AC or DC powering input power preference.”). Patent Owner also contends that “[t]wo different forward voltages can clearly be applied to the two different LED circuits—that is, one forward voltage for the ‘first operating LED circuit’ and a different forward voltage for the ‘one additional LED circuit.’” *Id.* at 39–40; *see* Sur-reply 14 (citing PO Resp. 26–27) (Patent Owner arguing that Petitioner “ignores the fact that the two LED

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circuits connected together create a combined circuit that uses two different forward voltages depending on whether it operates in parallel or series”).

*Second*, Patent Owner further contends that, “just because the circuit resides within a device does not mean it is no longer a circuit,” “[n]or does the fact that a multi-voltage circuit is composed of two or more single voltage circuits mean that each of the single circuits cannot be driven with more than one voltage, or that the multi-voltage circuit is no longer a circuit.” PO Resp. 29; *see id.* at 28 (citing Ex. 1018, Fig. 9, ¶ 60); Sur-reply 4. Patent Owner contends that the term “‘LED circuit’ is a common term that a POSITA would understand covers numerous possible circuit configurations, not just single voltage LED circuits.” PO Resp. 30 (citing Ex. 2008 ¶ 84). Patent Owner further contends that “an LED circuit may be two LEDs and a switch that switches the LEDs between a parallel and a series configuration,” and that “[w]hether in the parallel or series configuration, it is still the same circuit, yet the two configurations would have different forward voltages.” *Id.* (citing Ex. 2008 ¶ 86). Patent Owner states that Figure 12 of the ’341 patent shows LED circuits that are connected in series and characterizes the LED circuits as “form[ing] *an* LED circuit with one forward voltage.” *Id.* at 41 (citing Ex. 2008 ¶ 99) (emphasis added). Patent Owner further states that “when the LED circuits are connected in parallel, the resulting LED circuit would have a second (different) forward voltage.” *Id.* at 41–42 (citing Ex. 2008 ¶ 99); *see* Sur-reply 15 (citing-in-part PO Resp. 13).

Patent Owner also contends that “different LED circuits are not limited to the same number of LEDs” and accordingly, “[a] POSITA would understand that LED circuits with various scalable or flexible configurations

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may need to be driven with multiple different forward voltages.” *Id.* at 24 (citing Ex. 1001, 10:17–18 (“LED circuits 12 configured in a[n] imbalanced bridge circuit.”)).

Patent Owner further contends “claim 1 (from which claim 3 depends) recites a switch capable of ‘switching a voltage level input’ to the LED circuits” and “[t]hus, the claim itself requires an LED circuit to have more than one voltage level options that can be delivered to the LED circuit and are selectable by a switch.” PO Resp. 40. According to Patent Owner, “the specification clearly and repeatedly teaches that LED circuits may have more than one voltage level.” *Id.* (citing Ex. 1001, 3:5–12 (“It would further be advantageous to provide multiple voltage level LED circuits . . . that can easily be electrically configured for at least two forward voltage drive levels”), 3:12–19). According to Patent Owner, these disclosures support a finding that “the ’341 Patent teaches connecting LED circuits in series and parallel configurations *to form new circuits*” and that “[*e*]ach of these new circuits may (depending on the configuration) have a different forward voltage.” *Id.* at 41 (citing Ex. 2008 ¶ 98) (emphases added); *see also* Sur-reply 22 (“[a] POSITA would understand that voltage can be increased across an LED to increase brightness” and “[i]ndeed, the dimmer aspect of the ’341 Patent is essentially disclosing one way to increase LED brightness”), 24 (“The ’341 Patent is also clear that forward voltage can be changed to increase brightness.” (citing Ex. 1001, 3:11–19; 7:3–8; 9:17–24; 11:31–35)).

*Third*, citing column 3, lines 12 through 19 of the ’341 patent, Patent Owner contends that

[t]his disclosure alone discloses “a switch” (e.g., switching means) “wherein switching the switch” (e.g., connecting or

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disconnecting the at least one additional LED circuit to and/or from a first LED circuit) “provides two different DC forward voltages” (e.g., more than one AC or DC forward voltage) to an LED circuit (one additional LED circuit or the first LED circuit or the combination of the one additional LED circuit with the first LED circuit). There are numerous other embodiments of the ’341 Patent disclosing similar configurations. To the extent there are minor differences between an embodiment and the specific claim language (e.g., the term “switch” is not explicitly mentioned in a particular embodiment or the embodiment does not specify whether it uses AC or DC), *a POSITA would easily understand how to implement those differences and would understand that they can look to other embodiments for the differences.*

PO Resp. 43–44 (citing Ex. 1001, 4:33–45, 5:35–51, 5:52– 6:3; Figs. 8, 9, 11, 12; Ex. 2008 ¶ 102) (emphasis added); *see* Sur-reply 14 (Patent Owner arguing that “[a] POSITA would understand how to use a switch to change between two forward voltage levels”), 22–23 (Patent Owner arguing that “[t]he circuits in Fig. 12 are provided as an exemplary ‘LED package 100’ that can be integrated into larger circuits and modified” which “would include, for example, ‘wiring’ the package to be switchable between series and parallel configurations” because “the ’341 Patent is meant to improve on the type of fixed prior art configuration Petitioner seeks to limit Fig. 12 to”).

### 3. *Petitioner’s Reply*

Petitioner responds to Patent Owner’s *first* argument by arguing that “providing a single forward voltage to one of the circuits and a different single forward voltage to the other circuit would not practice the claims, much less disclose and enable its full breadth.” Pet. Reply 17.

Petitioner responds to Patent Owner’s *second* argument by arguing that Patent Owner’s “attempt to characterize the entirety of LED device 100 as a single claimed LED circuit fails because the claims require multiple

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LED circuits,” that is, the claimed “first operating LED circuit” and the claimed “at least one additional LED circuit.” *Id.*

Petitioner responds to Patent Owner’s *third* argument by arguing that Patent Owner “fails to address that the claims require that the switching of the switch provide the at least two different forward voltages, which is not disclosed.” *Id.* (citing PO Resp. 39–40). Petitioner characterizes Patent Owner as “argu[ing] that claim 1 requires the switch provide multiple ‘voltage level options,’” and argues that this “does not address whether a switch can provide two different ‘forward voltages’ as required by claim 3, i.e., two different minimums, under Petitioner’s construction.” *Id.* (citing PO Resp. 40). Petitioner also contends that “no switch is disclosed that would provide multiple ‘DC forward voltages’ to the LED device 100 as a whole.” *Id.* at 18 (citing Pet. 17–20).

Petitioner also argues that Patent Owner’s “conclusion with respect to claim 3 and Figure 12 . . . is incorrect.” *Id.* (citing PO Resp. 41–42). According to Petitioner, “LED device 100 can be wired into either a parallel or a serial configuration *during manufacture*, and the resulting LED device 100 will then have *one* of two different possible forward voltages and will be coupled to the appropriate voltage source.” *Id.* (citing Pet. 11–12; Ex. 1002 ¶ 22) (emphasis added). Petitioner contends that “[t]he forward voltage *provided to the two LED circuits 92 within* LED device 100 will be the same regardless of the configuration.” *Id.* (citing Pet. 11–12; Ex. 1002 ¶ 22) (emphasis added).

#### 4. 35 U.S.C. § 112(a)

With respect to the *written description requirement*, we are persuaded that under the construction of “forward voltage” adopted in Section III.C,

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written description support is lacking in the '295 application underlying the '341 patent.<sup>15</sup>

Claims 3, 10, and 17 recite “wherein the switching of the switch provides at least two different DC forward voltages to *at least one of* the first operating LED circuit or the at least one additional LED circuit.”

With regard to Patent Owner’s *first* argument, encompassed within the scope of each of claims 3, 10, and 17 are three situations: (1) when two different DC forward voltages are provided to *only* the first operating LED circuit; (2) when two different DC forward voltages are provided to *only* the at least one additional LED circuit; and (3) when two different DC forward voltages are provided to the first operating LED circuit *and* the at least one additional LED circuit. We agree with Petitioner’s position—that it is necessary to support the full breadth of these claims (i.e., all three situations)—and not merely one of the three situations, as Patent Owner contends. *See* Pet. 19; PO Resp. 27, 39–40; *see also LizardTech, Inc. v. Earth Resource Mapping, Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005) (“Whether the flaw in the specification is regarded as a failure to demonstrate that the patentee possessed the full scope of the invention recited in [a] claim . . . or a failure to enable the full breadth of that claim, the specification provides inadequate support for the claim under section 112, paragraph one.”).

The '295 application does not provide sufficient written description support for situations (1) and (2) under our adopted construction of “forward

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<sup>15</sup> Here and below, we consider the parties’ citations to and discussion of '597 PCT relevant to our analysis of the '295 application because the '597 PCT and the '295 application have substantially similar disclosures.

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voltage” as it appears in the claim term “two different DC forward voltages” recited in claims 3, 10, and 17. *Supra* § III.C (forward voltage is construed as “the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs”). The cited portions of the ’597 PCT disclose “a first forward voltage drive level when the two single voltage LED *circuits are connected in parallel* and a second forward voltage drive level that is twice the level of the first forward voltage drive level when the at least two LED *circuits are connected in series*.” Ex. 1018 ¶¶ 28 (emphasis added), 30; *supra* n.14 (considering citations to the ’597 PCT relevant to the analysis of the ’295 application because the ’597 PCT and ’295 application have substantially similar disclosures). That is, the forward voltage drive level in the ’597 PCT depends on whether the (at least) two single voltage LED circuits are connected together in parallel or in series. This is distinguishable from situations (1) and (2) because the cited portions do not disclose that the two different forward voltage drive levels are applied to *only* one single voltage LED circuit—the cited portions describe only a situation in which at least *two* LED circuits are required.

Patent Owner’s *first* argument is unpersuasive because the configuration changes that Patent Owner references in the ’295 application and the ’341 patent are disclosed as being based on the type of wiring connection, parallel or serial, between *two* LED circuits, i.e., the “at least one of the first operating LED circuit” and the “the at least one additional

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LED circuit.”<sup>16</sup> The disclosures of the ’295 application and the ’341 patent do not address the situation in which (1) the two different DC forward voltages are provided to *only* the first operating LED circuit, nor the situation in which (2) two different DC forward voltages are provided to *only* the at least one additional LED circuit.

We are persuaded by Petitioner that Patent Owner’s *second* argument that draws the LED circuit “box” around two single voltage LED circuits is unavailing as the independent claims from which dependent claims 3, 10, and 17 require both a “first operating LED circuit” and “at least one additional circuit.” *See* Pet. Reply 17. For this reason, Patent Owner’s argument that Petitioner’s challenge “ignores the fact that the two LED circuits connected together create a combined circuit that uses two different forward voltages depending on whether it operates in parallel or series” is unavailing. Sur-reply 14 (citing PO Resp. 26–27). The claims require multiple LED circuits—that is, the claimed “first operating LED circuit” and the claimed “at least one additional LED circuit.” Pet. Reply 18.

We further agree that “[t]he forward voltage provided to the two LED circuits 92 *within* LED device 100 will be the same regardless of the configuration.” Pet. Reply 18 (citing Pet. 11–12; Ex. 1002 ¶ 22) (emphasis added). Petitioner’s counsel clarified, during the hearing, that there is no disclosure that would support a finding that the switch provides two different forward voltages, for example, by switching the wiring configuration (e.g., from serial to parallel or vice versa) *between* two LED circuits.

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<sup>16</sup> Patent Owner cites to portions of the ’341 patent. We cite the corresponding portions of the ’295 application as is relevant to our determinations regarding challenges based on 35 U.S.C. §§ 112(a)–(b).

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JUDGE ULLAGADDI: [C]ouldn't it be argued that there's one DC forward voltage applied when it's in a first configuration between these two single voltage LED circuits and a second DC forward voltage when it's in the other configuration?

MR. ERICKSON: No, it cannot, Your Honor, for two reasons. First, the claim requires that a switch provide the different DC-forward voltages, and nowhere is there disclosure of a switch that switches between the serial and parallel embodiments. So that's the first reason why that argument would fail.

The second reason why that argument would fail is that the claim at issue requires the different DC voltages be applied to at least one of the first or the one additional circuit. And when you switch those between parallel and serial, you're always providing 6 volts. In this example, if the individual LED circuits are 6 volt LED circuits. if they're in parallel, the driver applies 6 volts. You're always getting 6 volts to each LED. If they're in series, the driver provides 12 volts to the series, but that results in 6 volts being applied to each LED circuit.

Tr. 9:17–10:8. We credit the testimony of Dr. Neikirk, who testifies that, when “the two 6V LED circuits are wired in parallel, the LED device will have a 6V forward voltage” and “the two 6V LED circuits are wired in series, the LED device will have a 12V forward voltage.” Ex. 1002 ¶ 22 (citing Ex. 1001, Fig. 4, Fig. 5, 10:49–64). That is, in either case, the voltage drop across one LED circuit is the same as the voltage drop across the other LED circuit. Accordingly, Patent Owner's argument that “[t]wo different forward voltages can clearly be applied to the two different LED circuits—that is, one forward voltage for the ‘first operating LED circuit’ and a different forward voltage for the ‘one additional LED circuit’” is unavailing. PO Resp. 39–40.

In response to Patent Owner's argument that “different LED circuits are not limited to the same number of LEDs” and accordingly, “[a] POSITA

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would understand that LED circuits with various scalable or flexible configurations may need to be driven with multiple different forward voltages,” this may be relevant to situation (3), but does not address situations (1) or (2) set forth above. *See* Sur-reply 24 (citing Ex. 1001, 10:17–18 (“LED circuits 12 configured in a[n] imbalanced bridge circuit.”)).

Patent Owner’s arguments that “[a] POSITA would understand that voltage can be increased across an LED to increase brightness,” that “the dimmer aspect of the ’341 Patent is essentially disclosing one way to increase LED brightness,” and that “[t]he ’341 Patent is also clear that forward voltage can be changed to increase brightness” are inapposite. Sur-reply 22, 24 (citing Ex. 1001, 3:11–19; 7:3–8; 9:17–24; 11:31–35)). The voltage used to drive an LED or circuit, which can be increased or decreased, is not the same as or equivalent to the claimed “forward voltage,” which is “*the minimum* voltage difference required between the anode and cathode of the LEDs in the claimed circuit *to allow current to flow* through the LEDs” as construed in Section III.C. Patent Owner’s Sur-reply arguments are unavailing for similar reasons:

Petitioner argues that a switch could not change the forward voltage by cutting it in half or doubling it. Petitioner confuses the difference between providing forward voltages to several LED circuits (as required by the claims) and providing forward voltages to a single LED. If a switch is switching between different LED circuits (for example, an LED circuit in parallel and an LED circuit in series), then the forward voltage might easily be doubled or halved. *On the other hand, if a switch is increasing current to a single LED, then the voltage would increase gradually.* PO’s expert testimony is fully consistent with this understanding.

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Sur-reply 8 (citing Pet. Reply 6) (emphasis added).

With regard to Patent Owner's *third* argument, the cited portion in column 3, lines 12 through 19 of the '341 patent discloses that

[the] invention comprises circuits and devices that can be driven with more than one AC or DC forward voltage “multi-voltage” at 6V or greater based on a selectable desired operating voltage level that is achieved by electrically connecting the LED circuits in a series or parallel circuit configuration and/or more than one level of brightness “multi-brightness” based on a switching means that connects and/or disconnects at least one additional LED circuit to and/or from a first LED circuit.

Ex. 1001, 3:12–19. At best, the cited portion of the '341 patent (and the corresponding portion of the '295 application) indicates that the “switching means” connects and disconnects LED circuits. *Id.* The cited portion does not indicate that the switch is capable of changing the configuration of the interconnection between LED circuits from series to parallel or vice versa. *Id.* Nor does it indicate that the switch is the electrical component that “provides at least two different DC forward voltages” to “the first operating LED circuit” or to “the at least one additional LED circuit,” as encompassed by the scope of claims 3, 10, and 17.

Patent Owner takes the position that

[t]o the extent there are minor differences between an embodiment and the specific claim language (e.g., the term ‘switch’ is not explicitly mentioned in a particular embodiment or the embodiment does not specify whether it uses AC or DC), a POSITA would easily understand how to implement those differences and would understand that they can look to other embodiments for the differences.”

PO Resp. 43–44; *see* Sur-reply 14 (Patent Owner arguing that “[a] POSITA would understand how to use a switch to change between two forward voltage levels”). However, the claimed subject matter must be disclosed in

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the specification—it is not sufficient for the claimed subject matter to be obvious in view of the specification’s disclosure. *Ariad*, 598 F.3d at 1351 (holding that “the test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had *possession* of the claimed subject matter as of the filing date” and that “a description that merely renders the invention obvious does not satisfy the requirement” (emphasis added)); *Turbocare Div. of Demag Delaval Turbomachinery Corp. v. Gen. Elec. Co.*, 264 F.3d 1111, 1119 (Fed Cir. 2001) (affirming summary judgment for failing to satisfy the written description requirement where the “original disclosure is completely lacking in any description of an embodiment in which the spring is located” where claimed, and holding that, although “[s]uch an embodiment may have been obvious from” that disclosure, “that is not enough to satisfy the written description requirement”); *Rivera v. International Trade Commission*, 857 F.3d 1315, 1322 (Fed. Cir. 2017) (finding that “[t]he specification [] does not teach a container with an integrated filter, and so, does not provide written description support for such a container, even if that type of container might be rendered obvious by the specification”). Similarly, Patent Owner’s argument that “[t]he circuits in Fig. 12 are provided as an exemplary ‘LED package 100’ that can be integrated into larger circuits and modified” which “would include, for example, ‘wiring’ the package to be switchable between series and parallel configurations” is unavailing because the “original disclosure is completely lacking in any description of an embodiment in which” the “‘wiring’. . . [is] switchable between series and parallel configurations.” Sur-reply 22–23; *see* Pet. Reply 18.

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We further disagree that Petitioner is attempting to read any particular embodiment into claims 3, 10, and 17. None of the embodiments, considered individually or in combination, discloses or enables the full breadth of claims, as Petitioner contends. *See* Pet. 31–32.

Based on the complete record developed during trial, Petitioner establishes, by a preponderance of the evidence, that claims 3, 10, and 17 lack sufficient written description support in the '295 application underlying the '341 patent as required by 35 U.S.C. § 112(a).

Separate from the written description requirement, 35 U.S.C. § 112(a) includes an *enablement* requirement. *Ariad Pharmaceuticals, Inc. v. Eli Lilly and Co.*, 598 F.3d 1336, 1344 (Fed. Cir. 2010) (*en banc*). Enablement requires the specification of a patent to “teach those skilled in the art how to make and use the full scope of the claimed invention without ‘undue experimentation.’” *Genentech, Inc. v. Novo Nordisk, A/S*, 108 F.3d 1361, 1365 (Fed. Cir. 1997) (quoting *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993)); *see also Amgen v. Sanofi*, No. 21-757, 598 U.S. \_\_\_, slip op. at 13 (2023) (“[T]he specification must enable the full scope of the invention as defined by its claims.”).

Petitioner’s “impossibility of multiple minimum voltages” arguments with respect to the inventions recited in claims 3, 10, and 17 are persuasive to show a lack of written description as discussed above, as well as to show a lack of enablement, indefiniteness, and PGR eligibility, as discussed below. We agree that, “[b]ecause each circuit has only one such minimum, there is only one ‘forward voltage’ for each circuit, and no switch can

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provide ‘at least two different DC forward voltages’ to either [individual] circuit.” Pet. 18.

As we discussed above, the ’295 application (and the ’341 patent) addresses two different forward voltages based on the type of wiring connection, parallel or serial, between *two* circuits, i.e., the “at least one of the first operating LED circuit” and “the at least one additional LED circuit.” Similar to what we discussed above, the disclosures of the ’295 application and the ’341 patent do not address or explain how it would even be possible to apply two different minimum voltages for the very same circuit as would be necessary in two of the three situations encompassed by the scope of claims 3, 10, and 17, i.e., the situations in which: (1) the two different DC forward voltages are provided to *only* the first operating LED circuit; and (2) two different DC forward voltages are provided to *only* the at least one additional LED circuit. We further note that the portions of the ’295 application corresponding to the portions of the ’341 patent cited by Petitioner refer to the disclosed LED circuits as “single voltage LED circuits.” Ex. 1003, 17–19 (’295 application as filed, paragraphs 28 and 30). This disclosure further lends support to a finding that multiple minimum voltages are not applied to individual circuits, the single voltage LED circuits, unless at least two of these single voltage LED circuits are connected together.

Based on the complete record developed during trial, we are persuaded that Petitioner establishes, by a preponderance of the evidence, that the ’295 application underlying the ’341 patent lacks enabling disclosure supporting claims 3, 10, and 17 as required by 35 U.S.C. § 112(a).

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For the purposes of the analysis of PGR eligibility in Section III.F *infra*, we also determine that neither the '597 PCT nor the applications intervening between the '597 PCT and the '295 application provide sufficient written description support or enabling disclosure for claims 3, 10, and 17 for the same reasons discussed above.

5. 35 U.S.C. § 112(b)

We are persuaded that it is more likely than not that the '295 application underlying the '341 patent “fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention.” *Nautilus*, 572 U.S. at 901. That is, it is unclear what the scope of claims 3, 10, and 17 is, given that a POSITA could not possibly apply two different DC forward voltages, under the construction of “forward voltage” that we adopted in Section III.C, to only one of the two single voltage LED circuits. That is, apply two different DC forward voltages to: (1) *only* the claimed the first operating LED circuit; or (2) *only* the at least one additional LED circuit, as is encompassed by the scope of claims 3, 10, and 17. We are persuaded that Petitioner establishes that claims 3, 10, and 17 are indefinite because it would have been impossible to apply two different minimum voltages (i.e., the claimed “two different DC forward voltages”) to only one single voltage LED circuit (i.e., only one of the claimed first operating circuit and the at least one additional circuit). *Cf. Synchronoss Techs., Inc. v. Dropbox, Inc.*, 987 F.3d 1358, 1366–67 (Fed. Cir. 2021) (finding the challenged claims indefinite and therefore invalid because they “nonsensical and require an impossibility—that the digital media file contain a directory of digital media files”).

Based on the complete record developed during trial, we are

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persuaded that Petitioner establishes, by a preponderance of the evidence, that claims 3, 10, and 17 are indefinite under 35 U.S.C. § 112(b).

*E. Challenge 2—Lack of Written Description and Enablement, and Indefiniteness of Claims 4, 11, and 18*

Petitioner contends that claims 4, 11, and 18 are invalid (i) because the Specification does not describe or enable the allegedly impossible subject matter and thus, these claims lack written description and enabling support in the '295 application or the '341 patent; and (ii) because claims 4, 11, and 18 are drawn to impossible subject matter, they are also indefinite. Pet. 32–33.

*1. Petitioner's Initial Contentions*

Petitioner argues that claims 4, 11, and 18 of the '341 patent claim “impossible subject matter [that] is not disclosed in the Pre-AIA Applications,” particularly because “the independent claims define the ‘LED lighting device’ [as] compris[ing] the switch, but the dependent claims [4, 11, and 18] require that the switch be ‘between’ that same ‘LED lighting device’ and the power source.” Pet. 20–21.

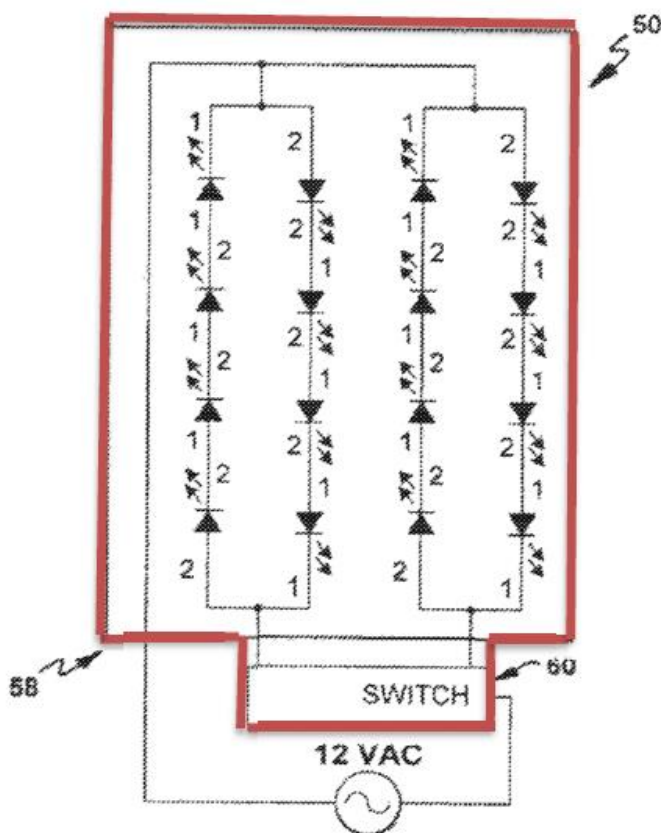
*2. Patent Owner's Response and Sur-reply*

Patent Owner disputes Petitioner's position and contends that “[t]hese features [of dependent claims 4, 11, and 18] are clearly supported and disclosed in the '597 [PCT] Application” because Figures 7 and 9 of the '597 Application “clearly disclose 2-way switch 60 connected between an AC power source and an LED lighting device” and because “the '597 Application discloses embodiments where the switch is part of the LED lighting device. PO Resp. 32–33 (citing Ex. 1018 ¶¶ 57, 58, Figs. 7, 9). Patent Owner argues that “[t]here does not appear to be any dispute that this claim is directed toward an arrangement similar to Fig. 7, except that the box

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50 comprising the LED device is extended to encompass switch 60 as shown in the red box,” reproduced below. *Id.* at 45.

**FIG. 7**



Patent Owner’s annotated version of Figure 7 of the ’341 patent. *Id.* at 46.

Patent Owner alternatively contends that the claimed switch acts as an interface:

While the independent claims characterize the LED device as “comprising” the switch, a POSITA would understand that Claims 4, 11 and 18 are simply specifying where in the LED device the switch would be connected relative to the power source. In other words, the claims are directed to a switch that acts as the interface between the AC voltage power source and the LED lighting device. By acting as the interface, this switch is

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both *a part of* the LED lighting device (as the independent claims require) and *between* the AC voltage power source and the LED lighting device (as the dependent claims require).

*Id.* at 46–47 (citing Ex. 1001, Figs. 7, 9 (Patent Owner arguing that the cited figures show a switch located between a voltage source and the rest of a LED device)); *see* Sur-reply 16–17, 25–26.

### 3. *Petitioner’s Reply*

Petitioner’s responds that claims 4, 11, and 18 “are nonsensical because they require the switch, which is part of the LED lighting device, to be connected to itself.” Pet. Reply 14 (citing *Becton, Dickinson and Co. v. Tyco Healthcare Group, LP*, 616 F.3d 1249, 1254–56 (Fed. Cir. 2010)).

Petitioner contends that “[Patent Owner’s] assertion that these claims are disclosed in Figures 7 and 9 and [0057]-[0058] of the ’597 PCT is wrong for multiple reasons.” *Id.* (citing PO Resp. 32–33). Petitioner contends that “[e]ach of Figures 7 and 9 and the accompanying text discloses a switch that is external to the LED device.” *Id.* (citing Ex. 1018 ¶ 59 (“switch 74 is electrically connected between the multi-brightness LED device 62 and the AC voltage source 78”)). According to Petitioner, “[n]othing in those disclosures describe how the switch can be both a part of the LED lighting device and between that device and the AC voltage source.” *Id.* (citing Ex. 1034 ¶¶ 25–27).

### 4. *35 U.S.C. § 112(a)*

Patent Owner’s arguments are unavailing. As to Patent Owner’s initial contention, Patent Owner cites portions in Figures 7 and 9 of the ’597 PCT and the ’341 patent that depict switch 60 as being external to multi-voltage and/or multi-brightness LED lighting device 50 and lamp 58 in Figure 7 and depict two-way switch 74 as external to multi-brightness LED lighting

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device 62 in Figure 9. *See* PO Resp. 32–33 (citing Ex. 1018 ¶¶ 57, 58, Figs. 7, 9). Patent Owner also cites paragraphs 57 and 58 of the '597 PCT in support of its argument. *Id.*; *supra* n.14. Paragraph 57 of the '597 PCT describes Figure 7 and does not disclose how switch 60 is part of LED lighting device 50 and/or lamp 58. Ex. 1018 ¶ 57. Paragraph 58 of the '597 PCT describes Figure 8, which depicts “at least two bridge rectified 68 series LED circuits 69,” but does not depict a switch, let alone one included within multi-brightness LED lighting device 62. *Id.* ¶ 58. The cited figures of the '597 PCT do not depict and the cited portions do not describe how the claimed “switch” can be a constituent part of the LED lighting device of independent claims 1, 9, and 15 *and* be between the LED lighting device and AC voltage power source as required by claims 4, 11, and 18. Even assuming, *arguendo*, Patent Owner could cite to any support for re-drawing the box corresponding to multi-voltage and/or multi-brightness LED lighting device 50 in its annotated version of Figure 7 to *include* switch 60, Patent Owner's annotated version of Figure 7 still would not support a finding that switch 60 is *between* LED lighting device 50 and the AC voltage source.

As to Patent Owner's alternative “interface” contention, even assuming, *arguendo*, that Patent Owner cited to sufficient underlying evidence or support for characterizing the switch as an “interface,” such evidence would still not support a finding that the claimed “switch” could be *part* of the LED lighting device of independent claims 1, 8, and 15 *and* also be “connected between the AC voltage power source and the LED lighting

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device,” as recited in claims 4, 11, and 18, which depend directly from claims 1, 8, and 15.

We agree that the portions of the ’295 application corresponding to the portions of the ’341 patent and the ’597 PCT cited by Patent Owner do not and cannot show the claimed switch as being part of the claimed LED lighting device and at the same time being disposed between the voltage source and the claimed LED lighting device.

We are persuaded that the Petition shows by a preponderance of the evidence that claims 4, 11, and 18 lack sufficient written description support in the ’295 application underlying ’341 patent as required by 35 U.S.C. § 112(a).

With regard to the *enablement* requirement, we are persuaded that the ’295 application does not “teach those skilled in the art how to make and use the full scope of the claimed invention without ‘undue experimentation’” because it is “impossible” for the switch to be both part of the LED lighting device and between the LED lighting device and the voltage source, as discussed above in this section.

We are persuaded that the Petition shows by a preponderance of the evidence that claims 4, 11, and 18 lack sufficient enabling disclosure in the ’295 application underlying ’341 patent as required by 35 U.S.C. § 112(a).

For the purposes of the analysis of PGR eligibility in Section III.F *infra*, we also determine that neither the ’597 PCT nor the applications intervening between the ’597 PCT and the ’295 application provide

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sufficient written description support or enabling disclosure for claims 4, 11, and 18 for the reasons discussed above.

5. *35 U.S.C. § 112(b)*

We are persuaded that the '295 application underlying the '341 patent “fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention” for reasons similar to those discussed above.

*Nautilus*, 572 U.S. at 901. That is, it is unclear what the scope of claims 4, 11, and 18 is, given that a POSITA could not possibly make the claimed switch both a constituent part of the claimed LED lighting device (as required by claims 1, 8, and 15 from which claims 4, 11, and 18 directly depend) *and* dispose it between the claimed LED lighting device and the claimed AC voltage power source (as required by claims 4, 11, and 18).

In view of the above, the Petition establishes by a preponderance of the evidence that claims 4, 11, and 18 are indefinite under 35 U.S.C. § 112(b).

*F. Eligibility for Post-Grant Review*

The post-grant review provisions set forth in section 6(d) of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (September, 2011) (“AIA”), apply only to patents subject to the first-inventor-to-file provisions of the AIA. *See* AIA § 6(f)(2)(A) (stating that the provisions of Section 6(d) “shall apply only to patents described in section 3(n)(1)”). Patents subject to the first-inventor-to-file provisions are those that issue from applications “that contain[] or contained at any time . . . a claim to a claimed invention that has an effective filing date as defined in section 100(i) of title 35, United States Code, that is on or after” March 16, 2013. AIA § 3(n)(1); *see supra* n.4. “A petition for a post-grant review may

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only be filed not later than the date that is 9 months after the date of the grant of the patent or of the issuance of a reissue patent (as the case may be).” 35 U.S.C. § 321(c).

Petitioner contends that the ’341 patent is eligible for post-grant review because, even if some of the claims are entitled to the benefit of a filing date before March 16, 2013 by virtue of the parent application(s), (i) challenged claims 3, 4, 10, 11, 17, and 18 have an earliest effective filing date that is on or after March 16, 2013, and (ii) one of the parent applications of the ’341 patent that issued as a patent contains claims having earliest effective filing dates on or after March 16, 2013. Pet. 16–23. Petitioner further contends that the Petition was filed within nine months of the issue date of the ’341 patent. *Id.* at 3.

Patent Owner argues that, “[t]o the extent the Board determines claims 3, 4, 10, 11, 17, or 18 are not supported by Pre-AIA Applications because it determines that the claims are impossible, the claims are still ineligible for post-grant review because new matter added during prosecution cannot convert pre-AIA claims to post-AIA claims.” PO Resp. 36. According to Patent Owner,

[t]he Final Guidelines for Implementing the First Inventor To File Provisions of the AIA provide that “an amendment (other than a preliminary amendment filed on the same day as [the] application) seeking to add a claim to a claimed invention that is directed to new matter in an application filed on or after March 16, 2013, that, as originally filed, discloses and claims only subject matter also disclosed in a previously filed pre-AIA application to which the application filed on or after March 16, 2013, is entitled to priority or benefit under 35 U.S.C. 119, 120, 121, or 365, would not change the application from a pre-AIA application into an AIA application.”

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*Id.* at 37 (citing 78 Fed. Reg. 11,083 (Feb. 14, 2013) (Ex. 2015)); *see* Sur-reply 20–21 (Patent Owner arguing, in part, that “the Guidelines clarify that a claim to new matter does not have a filing date and therefore does not impact the other claims in the patent, not contradicting the AIA”).

AIA § 3(n)(1) reads as follows:

(n) EFFECTIVE DATE. —

(1) IN GENERAL. — Except as otherwise provided in this section, the amendments made by this section shall take effect upon the expiration of the 18-month period beginning on the date of the enactment of this Act, and shall apply to any application for patent, and to any patent issuing thereon, that contains or contained at any time—

- (A) a claim to a claimed invention that has an effective filing date as defined in section 100(i) of title 35, United States Code, that is [after March 15, 2013]; or
- (B) a specific reference under section 120, 121, or 365(c) of title 35, United States Code, to any patent or application that contains or contained at any time such a claim.

We are persuaded by Petitioner’s response that “[t]he statute’s [AIA § (3)(n)(1)] explicit [language] ‘contains or contained at any time’ limitation on ‘a claim’ does not provide for, nor permit, an exception for claims added by amendment during prosecution.” Pet. Reply 10. Petitioner also persuasively argues that the “‘Examination Guidelines’ cited by Patent Owner do not conflict with the statute defining *PGR eligibility of issued patents*.” *Id.* (emphasis added).

To determine whether any of claims 3, 4, 10, 11, 17, and 18 of the ’341 patent is entitled to a right of priority and effective filing date based on the ’597 PCT (i.e., the first application in the priority chain filed before 2013), we determine whether the earlier-filed application satisfies the following two requirements set forth in 35 U.S.C. § 112(a)—“(1) a written

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description of the subject matter of the claim(s) at issue in the later filed nonprovisional application, and (2) an enabling disclosure to permit one of ordinary skill in the art to make and use the claimed invention in the later filed nonprovisional application without undue experimentation.” *See* MPEP § 211.05.

We are persuaded that the ’597 PCT lacks sufficient written description support for the inventions recited in claims 3, 10, and 17 of the ’341 patent. *Supra* § III.D. Dependent claims 3, 10, and 17 of the ’341 patent are therefore not entitled to an effective filing date as early as that of the ’597 PCT (i.e., 2010). *Id.* Independently, the ’597 PCT lacks an enabling disclosure for the inventions recited in claims 3, 10, and 17 of the ’341 patent—for this additional reason, these claims do not receive an effective filing date corresponding to the ’597 PCT.

Our determinations of lack of written description support and lack of enabling disclosure for claims 4, 11, and 18 and ’597 provide two additional, independent bases for PGR eligibility. *See* AIA § 3(n)(1).

We further do not agree with Patent Owner that Petitioner is arguing that “the claims are not entitled to any priority date at all,” nor do we agree that the claims are not entitled to any priority date. PO Resp. 32. In this case, the effective filing date is, at best, only as early as the filing date of the ’295 application from which the ’341 patent matured. Patent Owner has not demonstrated that any of the applications intervening between the ’597 PCT and the ’295 application—U.S. Patent Application Nos. 16/274,164, 15/685,429, and 14/172,644—provide sufficient support (i.e., enablement or written description) for claims 3, 4, 10, 11, 17, and 18 of the ’341 patent. The ’295 application was filed on January 10, 2020, which is after March

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16, 2013, and thus the first-inventor-to-file provisions of the AIA apply to our analysis of *all* of the challenged claims. *See supra* n.4.

We further determine that Petitioner filed the Petition within the 9-month statutory period for requesting post-grant review in accordance with 35 U.S.C. § 321(c). The '341 patent issued on February 23, 2021 (*see* Ex. 1001, code (45)), and the Petition in this proceeding was accorded a filing date of November 12, 2021 (*see* Paper 4). Thus, the Petition was filed less than 9 months after the date of issuance of the '341 patent.

In view of the above, we are persuaded that PGR eligibility of the '341 patent is conferred by the effective filing date of claims 3, 4, 10, 11, 17, and 18.

Petitioner additionally argues that claims 1–15 of the '001 patent have an effective filing date on or after March 16, 2013 because none of the pre-AIA applications in the priority chain of the '001 patent disclose the subject matter of independent claims 1 and 11 and dependent claims 9 and 15 of the '001 patent. Pet. 21–23. Patent Owner disputes Petitioner's contentions. PO Resp. 15–16. As we determine that the '341 patent is PGR eligible on the basis of the effective filing date of claims 3, 4, 10, 11, 17, and 18, we need not determine whether any of claims 1–15 of the '001 patent have an effective filing date on or after March 16, 2013.

*G. Challenge 3—Anticipation by Bruning*

Petitioner contends that claims 1, 3, 5, 7, 8, 10, 12, 14, 15, 17, and 19 are unpatentable as anticipated under 35 U.S.C. § 102 over Bruning. Pet. 33–53. For the reasons that follow, we are persuaded that Petitioner demonstrates anticipation of claims 1, 5, 7, 8, 12, 14, 15, 17, and 19 by Bruning by a preponderance of the evidence.

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*1. Overview of Bruning*

Bruning is titled “Control and Drive Circuit Arrangement for Illumination Performance Enhancement with LED Light Sources.” Ex. 1004, code (54) (Title). Bruning “relates to backlighting of display panels, including the backlighting in LCD panels.” *Id.* ¶ 1. More particularly, Bruning discloses a backlight for an LCD display comprised of an array of LEDs, the backlight driven and controlled by a fast pulse power converter to provide a response time for the backlight on the order of microseconds. *Id.* at code (57) (Abstract).

Bruning’s Figure 4, reproduced below, illustrates an LED backlight. *Id.* ¶ 31.

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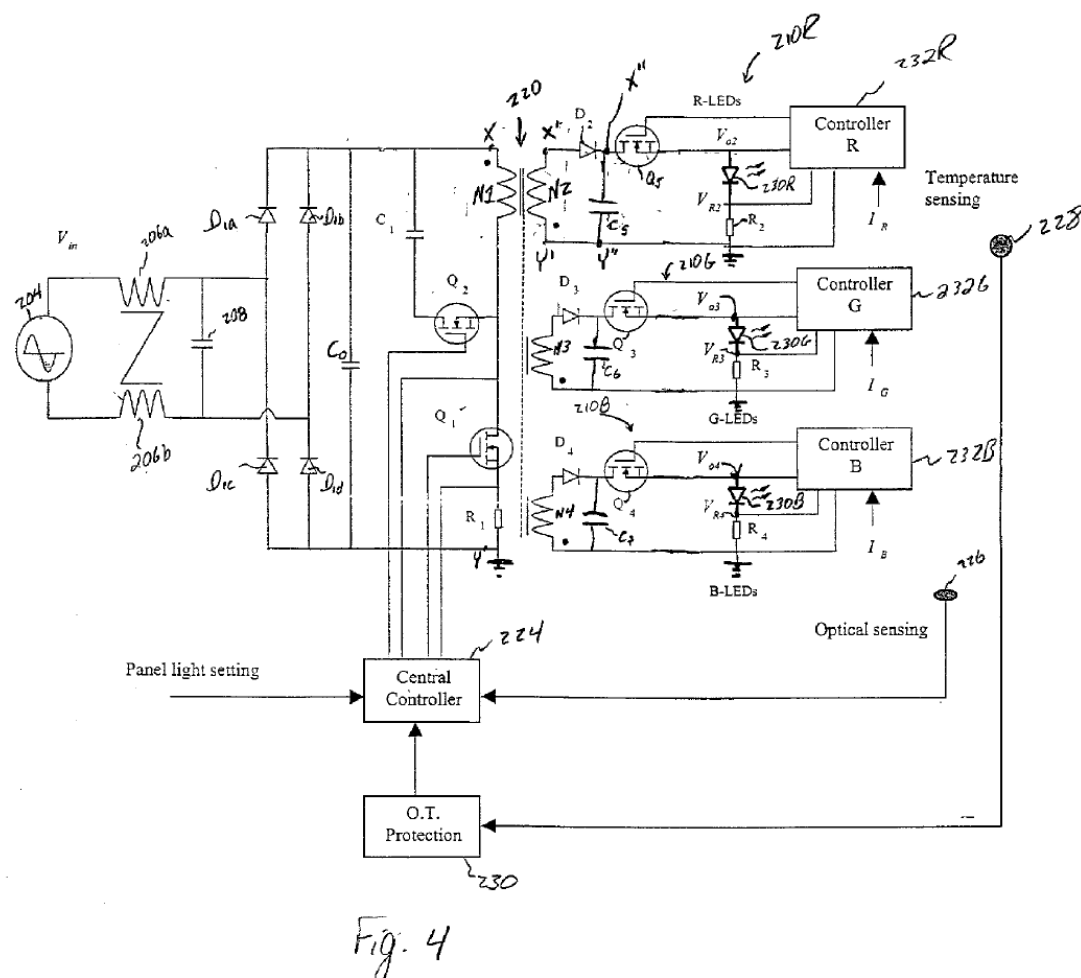


Figure 4 illustrates an LED backlight. *Id.* ¶ 31.

Figure 4 illustrates drive circuitry for an LED backlight. *Id.* The drive circuitry includes: an AC voltage source 204 connected to inductors 206a, 206b and capacitor 208; diodes D1a, D1b, D1c, D1d comprising a full wave rectification bridge circuit which provides full wave rectification of the AC input of AC source 204; capacitor C<sub>0</sub> for smoothing the rectified AC signal further into a first order DC voltage that is provided across points X–Y in Figure 4; and converter circuitry between points X and Y. *Id.* ¶¶ 31–32. The converter circuitry between points X and Y in Figure 4 includes a multiple output transformer 220, a switch Q<sub>1</sub>, and a resistor R<sub>1</sub>. *Id.* ¶ 32. Multiple

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output transformer 220 has a primary winding N1 and three secondary windings N2, N3, and N4 each magnetically coupled to the primary winding. *Id.* Secondary windings N2, N3, and N4 are included in LED sub-array circuits 210R, 210G, and 210B of an RGB LED array. *Id.*

Switch  $Q_1$  is cycled on and off by a central controller 224. *Id.* ¶ 33. When  $Q_1$  is on (closed), the rectified voltage applied across X–Y drops across primary winding N1; and when  $Q_1$  is off (open), the rectified voltage drops across switch  $Q_1$ . *Id.* When switch  $Q_1$  is “off,” the circuit between points X and Y is open. *Id.* ¶ 34. In addition, a negative voltage appears across primary winding N1, induced by secondary windings N2–N4, when  $Q_1$  is off. *Id.* During the “on” portions of a switching cycle of switch  $Q_1$ , a voltage  $V_{X'-Y'}$  is created across points X' and Y' in LED sub-array 210R due to the induced voltage in secondary winding N2 created by current  $i_{N1}$ , in primary winding N1. *Id.* ¶ 35. Similar voltages are created in the other secondary windings (N3 and N4). *Id.*

LED sub-arrays 210R, 210G, and 210B generate the light output of the LED backlight 200 using applied voltages  $V_{R0}$ ,  $V_{G0}$ , and  $V_{B0}$ , respectively. *Id.* ¶ 40. Since turns ratios between primary winding N1 and secondary windings N2, N3, and N4 of transformer 220 are fixed, voltages  $V_{R0}$ ,  $V_{G0}$ ,  $V_{B0}$  applied to LED sub-arrays 210R, 210G, and 210B, respectively, are controlled by controller 224 by controlling the duty cycle of switch  $Q_1$ . *Id.* ¶ 38. And, since voltages  $V_{R0}$ ,  $V_{G0}$ ,  $V_{B0}$  establish the maximum level of light output of LED sub-arrays 210R, 210G, and 210B, respectively, the maximum level of light output by LED sub-arrays 210R, 210G, and 210B, respectively, are likewise controlled by controller 224, by controlling the duty cycle of switch  $Q_1$ . *Id.* In addition, a “panel light

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setting” input to central controller 224 (controlled by a user or by other input, including video input) adjusts the duty cycle of  $Q_1$  and thus the maximum light output of LED sub-arrays 210R, 210G, and 210B. *Id.*

The drive circuitry in Figure 4 further includes a switch  $Q_5$  and controllers 232R, 232G, and 232B. *See* Fig. 4. Switching  $Q_5$  on and off in a cyclical manner causes the current through red LED 230R to rise and fall in a cyclical manner, thus resulting in a cyclical rise and fall in the light output of red LED 230. *Id.* ¶ 42. Controller 232R independently controls the switching of switch  $Q_5$ . *Id.* The duty cycle set by controller 232R controls the amount of time that  $Q_5$  is turned on and off in a switching cycle. *Id.* Controller 232R and switch  $Q_5$  have response times on the order of microseconds; thus, the duty cycle may be on the order of microseconds. *Id.* Similarly, the light output of green and blue LED sub-arrays 210G and 210B are independently controlled by the independent controllers 232G and 232B. *Id.* ¶ 44. Thus, independent controllers 232R, 232G, and 232B determine the relative output of red, green, and blue light, respectively, output by LED sub-arrays 210R, 210G, and 210B, respectively. *Id.* Since the duty cycle of each controller (and the resulting cyclical change of light output) is on the order of microseconds, the eye integrates the separate color outputs into a resulting color composite. *Id.* Thus, controllers 232R, 232G, and 232B may be used to regulate the color point and/or color content of the generated white light. *Id.*

## 2. *Independent Claim 1*

[1.pre] “An LED lighting device comprising:”

Petitioner contends that “Bruning discloses an LED lighting device (Figs. 2, 4) comprising an LED backlight for a mobile device, including the

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claimed elements as shown below.” Pet. 34 (citing Ex. 1004, codes (54) (Title), (57) (Abstract), Figs. 1–5, ¶¶ 4, 7, 9–15, 24–29, 31–51; Pet. § VIII.A (Bruning overview); Ex. 1002 ¶ 67). Patent Owner does not contest Petitioner’s evidence and arguments with respect to the preamble. *See* PO Resp. Based our review of the complete record developed during trial, we are persuaded that Petitioner demonstrates sufficiently that Bruning discloses the preamble of claim 1.<sup>17</sup>

*[1.a] “a first operating LED circuit and at least one additional LED circuit”*

Petitioner contends “Bruning discloses a first operating LED circuit (LED sub-array circuit 210R) and at least one additional LED circuit (e.g., LED sub-array circuits 210G and 210B).” Pet. 34–35 (citing Ex. 1004 ¶¶ 31–44 (paragraph 40 disclosing “LED sub-array circuits 210R, 210G, 210B”)). Patent Owner does not contest Petitioner’s evidence and arguments with respect to this limitation. *See* PO Resp. Based our review of the complete record developed during trial, we are persuaded that Petitioner demonstrates sufficiently that Bruning discloses limitation 1.a.

*[1.b] “at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel”*

Petitioner contends that “Bruning discloses at least one of the first operating LED circuit (LED subarray circuit 210R) or the at least one additional LED circuit (e.g., LED sub-array circuits 210G and 210B)

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<sup>17</sup> We need not determine whether the preambles of any of claims 1, 8, and 15 are limiting because Petitioner persuasively shows that Bruning discloses the subject matter of the preambles in this third challenge and also persuasively shows that the combination of Bruning and Kabel teaches the subject matter of the preambles in the following, fourth challenge.

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including at least two LEDs connected in either series or parallel (‘One LED 230R is used in FIG. 4b to represent all of the LEDs in the sub-array 210R.’).” Pet. 36 (citing Ex. 1004 ¶¶ 24, 25, 31–44; Ex. 1002 ¶ 69).

Petitioner further contends that “Bruning discloses that each of the sub-arrays includes at least two LEDs connected in either series or parallel, and preferably includes redundant connections to minimize the impact of a failure or short of an LED.” *Id.* (citing Ex. 1004 ¶¶ 24, 25, 40; Ex. 1002 ¶ 70). Patent Owner does not contest Petitioner’s evidence and arguments with respect to this specific limitation. *See* PO Resp. Based on our review of the complete record developed during trial, we are persuaded that Petitioner demonstrates sufficiently that Bruning discloses limitation 1.b.

*[1.c] “the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit”*

Petitioner contends that Bruning discloses “the at least one additional LED circuit (e.g., sub-array circuits 210G and 210B emitting green and blue light, respectively) being configured to emit a different color light compared to the first operating LED circuit (LED sub-array circuit 210R emitting red light).” Pet. 36 (citing Ex. 1004 ¶¶ 4, 7, 9, 11, 12, 14, 15, 24–29, 37, 40, 48–50, Fig. 4; Ex. 1002 ¶ 71). Patent Owner does not contest Petitioner’s evidence and arguments with respect to this limitation. *See* PO Resp. Based on our review of the complete record developed during trial, we are persuaded that Petitioner demonstrates sufficiently that Bruning discloses limitation 1.c.

*[1.d] “a switch capable of at least one of: (a) switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit, or (b) switching the at least one additional LED circuit on or off” and*

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*[1.e] “wherein (a) or (b) is selectable by a user switching the switch, and”*

Petitioner contends:

Each of the “panel light setting” and “switch Q<sub>1</sub>” individually satisfies this limitation under the proper construction of “switch.”

...

Bruning discloses a switch (“switch Q<sub>1</sub>”) capable of switching a voltage level input to at least one of the first operating LED circuit (LED sub-array circuit 210R) or the at least one additional LED circuit (e.g., LED sub-array circuits 210G and 210B). Switch Q<sub>1</sub> controls the voltages VR<sub>0</sub>, VG<sub>0</sub>, VB<sub>0</sub> that are applied to the red, green, and blue LED sub-arrays 210R, 210G and 210B, respectively. Specifically, switch Q<sub>1</sub>’s duty cycle (controlled by the user via controller 224) controls the voltage applied to the LED circuits . . .

Additionally, Bruning discloses that “the duty cycle of Q<sub>1</sub> . . . may be used to adjust the overall intensity of the LED backlight.” This is because Q<sub>1</sub>’s duty cycle controls the applied voltages VR<sub>0</sub>, VG<sub>0</sub>, VB<sub>0</sub>, and the applied voltages VR<sub>0</sub>, VG<sub>0</sub>, VB<sub>0</sub> determine their respective circuits’ maximum current and maximum brightness level.

Pet. 38–39 (citing Ex. 1004 ¶¶ 26, 36–38, 45, Fig. 4a; Ex. 1002 ¶¶ 72–75) (third alteration in original).

Petitioner alternatively contends that

Bruning also discloses a switch (“panel light setting”) capable of switching a voltage level input to at least one of the first operating LED circuit (LED sub-array circuit 210R) or the at least one additional LED circuit (e.g., LED sub-array circuits 210G and 210B). Bruning discloses that the user directly controls the “panel light setting” switch to adjust Q<sub>1</sub>’s duty cycle. The setting of the panel light setting switch controls the voltages (VR<sub>0</sub>, VG<sub>0</sub>, VB<sub>0</sub>) that are applied to the red, green, and blue LED sub-arrays 210R, 210G and 210B, respectively, via controller 224 and switch Q<sub>1</sub> as discussed above.

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*Id.* at 39–40 (citing Ex. 1004 ¶ 38; Ex. 1002 ¶ 76). Petitioner also contends that Bruning discloses that

each of voltages (VR0, VG0, VB0) is selectable by a user switching the switch (panel light setting switch and switch Q1). The voltages are selectable by a user directly operating the panel light setting switch, which effects the change in the voltages via controller 224 and switch Q1 as discussed above. The voltages are selectable by a user indirectly operating switch Q1, which the user indirectly operates via the panel light setting switch and controller 224.

*Id.* at 40 (citing Ex. 1002 ¶ 78); *see* Ex. 1002 ¶ 77.

#### *Patent Owner’s Arguments*

Patent Owner argues the Bruning does not explicitly describe how its “panel light setting” works, nor does it describe the panel light setting as a switch. PO Resp. 56–57.

Rather, Patent Owner contends that the panel light setting is merely an input to central controller 224, which is the component that actually ‘adjusts the duty cycle of [transistor] Q1.’” *Id.* at 57 (citing Ex. 1004 ¶ 38). Patent Owner further argues that “switch Q1 is a transistor ‘controlled by controller 224,’ which sets the ‘duty cycle of switch Q1’” “and is therefore not capable of being switched by a user.” *Id.* at 53 (citing Ex. 1004 ¶¶ 37, 38); *see* Sur-reply 26. According to Patent Owner, “it would be ‘impossible’ for a user to perform the switching function of transistor Q1, which has cycles ‘each having a period on the order of **10 microseconds**.’” PO Resp. 54 (citing Ex. 1004 ¶ 33; Ex. 2010, 81:20–24). Patent Owner contends that “[a] user cannot possibly switch that fast, nor could a user reasonably switch that many times” and that “[u]ser input may influence the controller to set a different rate of switching for Q1, but Q1 still switches regardless of user input.” *Id.* at 54 (citing Ex. 2008 ¶ 117).

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Patent Owner also argues that “the claims require that the switch individually switch a single LED circuit.” *Id.* at 55 (citing Ex. 1001, claim 1); *see* Sur-reply 26–27. According to Patent Owner, “in Bruning[’s] Fig. 4, Q1, through primary winding N1, affects voltage to each of secondary windings N2-N4—and therefore LED circuits 210R, 210G and 210B—simultaneously,” but “does [not] individually switch any of these circuits.” PO Resp. 55–56 (citing Ex. 1004 ¶¶ 33, 34).

#### *Analysis of Parties’ Arguments*

With regard to Patent Owner’s argument about the Bruning’s “panel light setting,” Petitioner acknowledges, in its fourth challenge applying Bruning in view of Kabel, that Bruning does not explicitly describe how its “panel light setting” is implemented. Pet. 54. We do not view Petitioner’s acknowledgment as a deficiency of Petitioner’s third challenge because independent claim 1 does not include any limitations specifying how the switch should be implemented—rather, claim 1 includes limitations specifying the function(s) that the switch must perform. Patent Owner’s argument that Bruning does not explicitly describe the “panel light setting” as a switch is unavailing because the relevant inquiry is whether a POSITA would have understood Bruning’s “panel light setting” to disclose a switch that performs the claimed function(s) recited in independent claim 1.

We are persuaded by Petitioner’s argument that the user in Bruning “controls the ‘panel light setting’ switch to adjust Q1’s duty cycle.” *Id.* at 39 (citing Ex. 1004 ¶ 38); *see* Ex. 1004 ¶¶ 36, 37. Petitioner also persuasively points to Bruning’s disclosure of adjusting Q<sub>1</sub>’s duty cycle to affect “the voltages (VR0, VG0, VB0) that are applied to,” and “establish the maximum

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level of light output” by, “the red, green, and blue LED sub-arrays 210R, 210G and 210B.” Pet. 39–40 (citing Ex. 1002 ¶ 76); Ex. 1004 ¶ 38.

Patent Owner’s second argument again implicitly construes the claimed “switch” to be *directly* controlled by the claimed user, although Patent Owner apparently withdraws its construction, requiring the same, that was initially set forth in its Preliminary Response. *See generally* PO Resp. We discern no argument or evidence in the record in support of requiring the claimed “switch” to be directly controlled by the claimed “user.” Merely because “switch Q<sub>1</sub> is a transistor ‘controlled by controller 224’” does not mean that the switch is “not capable of being switched by a user.” *See* PO Resp. 53, 56 (citing Ex. 1004 ¶¶ 37, 38). Having reviewed the entire record developed during trial, we maintain our preliminary determination that the claims do not exclude controlling the claimed “switch” *indirectly*, for example, by a user through a controller. As such, we agree with Petitioner that switch Q<sub>1</sub> also teaches the claimed “switch” because switch Q<sub>1</sub> is indirectly controlled by the claimed “user” via controller 224 and/or via Bruning’s panel light setting. Because we determine that a user can *indirectly* control Bruning’s panel light setting, for example by using controller 224, the period length of the transistor’s cycles (i.e., on the order of microseconds) does not undermine the user’s ability to control the switching. *See id.* at 22 (citing Ex. 1004 ¶ 33).

We further discern no argument or evidentiary support in the record to support a finding that “the claims require that the switch individually switch a single LED circuit.” PO Resp. 55. Instead, we agree with Petitioner that “[t]he claims require a switch that switches a voltage level input to ‘at least one of’ the LED circuits, which literally encompasses switching a voltage

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level input to all of the LED circuits.” Pet. Reply 22 (citing Ex. 1035, 77:7–14).

Based upon our review of complete record developed during trial, we are persuaded that Petitioner demonstrates sufficiently that Bruning discloses limitations 1.d and 1.e.

*[1.f] “wherein the LED lighting device is configured to connect to an AC voltage power source”*

Petitioner points to Bruning’s disclosure of an “ac input of ac source 204” as disclosing this limitation. Pet. 40 (citing Ex. 1004 ¶¶ 13, 26, 31–44, Figs. 3, 4). Patent Owner does not contest Petitioner’s evidence and arguments with respect to this limitation. *See* PO Resp. Based our review of the complete record developed during trial, we are persuaded that Petitioner demonstrates sufficiently that Bruning discloses limitation 1.f.

For the foregoing reasons, we determine that Petitioner establishes by a preponderance of the evidence that claim 1 is anticipated by Bruning.

### 3. *Dependent Claims 3, 10, and 17*

Claims 3, 10, and 17 recite “wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.” As discussed above in Section III.C, we adopt one of Petitioner’s proposals for construing “forward voltage”—“the minimum voltage difference required between the anode and cathode of the LEDs in the claimed circuit to allow current to flow through the LEDs.” In Section III.D.5, under the adopted definition, we determine that claims 3, 10, and 17 were indefinite under 35 U.S.C. § 112(b). As we are unable to ascertain the scope of these claims, we cannot reach the merits of Petitioner’s prior art-based challenges to claims 3, 10, and 17. *Cf. Samsung Elecs. Am., Inc. v. Prisia Eng’g Corp.*, 948 F.3d

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1342, 1353 (Fed. Cir. 2020) (“[T]he proper course for the Board to follow, if it cannot ascertain the scope of a claim with reasonable certainty for purposes of assessing patentability, is to decline to institute the IPR or, if the indefiniteness issue affects only certain claims, to conclude that it could not reach a decision on the merits with respect to whether petitioner had established the unpatentability of those claims under sections 102 or 103.”).

#### 4. *Dependent Claims 5 and 7*

Claim 5 recites in part, “wherein the switching of the switch changes light output of the LED lighting device.” Patent Owner does not specifically address Petitioner’s challenge to dependent claim 5. *See generally* PO Resp. Petitioner persuasively cites Bruning’s disclosure of voltages VR0, VG0, VB0 that “establish the maximum level of light output of LED sub-arrays 210R, 210G and 210B, respectively.” Pet. 43 (citing Pet. VIII.B.1 (showing for claim 1); Ex. 1002 ¶ 83; Ex. 1004 ¶¶ 37, 40). Petitioner persuasively contends Bruning additionally “discloses that ‘the duty cycle of Q1 ... may be used to adjust the overall intensity of the LED backlight.’” *Id.* (citing Ex. 1004 ¶¶ 26, 45) (alteration in original). Petitioner contends, and we agree, “[a] POSITA would understand that the adjustment of the light output of the LED backlight is an adjustment to the perceived brightness of the laptop screen by a user.” *Id.* (citing Ex. 1002 ¶ 84).

Claim 7 recites in part, “a driver electrically coupled to the switch and at least one of the first operating LED circuit or the at least one additional LED circuit.” Patent Owner does not specifically address Petitioner’s challenge to dependent claim 7. *See generally* PO Resp. Petitioner persuasively contends that “Bruning discloses the LED lighting device of claim 1, further comprising a driver (‘drive circuitry’) electrically coupled to

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the switch (‘panel light setting’ switch) and at least one of the first operating LED circuit (LED sub-array circuit 210R) or the at least one additional LED circuit (e.g., LED sub-array circuits 210G and 210B).” Pet. 44 (citing Ex. 1004 ¶¶ 13, 31–44, code (57) (Abstract)).

According to Petitioner, “[t]he labeled driver in Figure 4 is circuitry that converts or conditions the power input—ac source 204—and supplies a power output to an LED circuit—the other sides of the transformer N1.” *Id.* at 46 (citing Ex. 1004 ¶ 31, Figs. 3–4; Ex. 1002 ¶ 86). Petitioner contends, and we agree, that “Bruning discloses that the driver is electrically coupled to the user-controlled panel light setting switch via central controller 224” and that Bruning’s “driver is electrically coupled to each of the LED circuits 210R, 210G, 210B, via secondary windings, diodes, transistors, and resistors, as shown in Figure 4.” *Id.* (citing Ex. 1004 ¶¶ 32, 33, 38, Fig. 4; Ex. 1002 ¶¶ 87, 88).

For the foregoing reasons, we determine that Petitioner establishes, by a preponderance of the evidence, that claims 5 and 7 are anticipated by Bruning.

### 5. *Independent Claim 8*

Independent claim 8 is substantially similar to independent claim 1 except that the claimed “switch” switches a “brightness level” instead of a “voltage level.” Claim 8 recites in part, “switching *a brightness level* of at least one of the first operating LED circuit or the at least one additional LED circuit.” Petitioner substantially refers to its analysis of independent claim 1 in support of independent claim 8. Pet. 46–48. Petitioner contends that “[e]ach of the ‘panel light setting’ switch and ‘switch Q1’ individually satisfies [the “brightness”] limitation under the proper construction of

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‘switch.’” *Id.* at 47 (citing Petitioner’s analysis of limitation 1.d (switches the voltage level) and claim 5 (switches the brightness level); Ex. 1002 ¶ 93).

As set forth above with respect to dependent claim 5 in Section III.G.3, Petitioner persuasively contends Bruning “discloses that ‘the duty cycle of Q1 . . . may be used to adjust the overall intensity of the LED backlight” and that “[a] POSITA would understand that the adjustment of the light output of the LED backlight is an adjustment to the perceived brightness of the laptop screen by a user.” *Id.* at 43 (citing Ex. 1004 ¶¶ 26, 45; Ex. 1002 ¶ 84). According to Petitioner, the duty cycle of Q<sub>1</sub> affects the applied voltages VR<sub>0</sub>, VG<sub>0</sub>, and VB<sub>0</sub> and “[t]he maximum brightness of each circuit is determined by the voltages VR<sub>0</sub>, VG<sub>0</sub>, VB<sub>0</sub> [which] are selectable by a user directly operating the panel light setting switch, which effects the change in the voltages via controller 224 and switch Q1.” *Id.* at 48 (citing Petitioner’s analysis of limitation 1.d; Ex. 1002 ¶¶ 94–95).

Patent Owner addresses independent claims 1, 8, and 15 together, and does not appear to make any arguments that are only applicable to independent claim 8. PO Resp. 20–23. As such, in finding Patent Owner’s arguments unavailing, we rely on our analysis set forth in Section III.G.2.

For the foregoing reasons, we determine that Petitioner demonstrates by a preponderance of the evidence that independent claim 8 is anticipated by Bruning.

#### 6. *Dependent Claims 12 and 14*

Dependent claims 12 and 14 recite features substantially similar to dependent claims 5 and 7, respectively. Petitioner refers to its showing for dependent claims 5 and 7 in support of its showing for dependent claims 12

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and 14. Pet. 48. We adopt our analysis with respect to claims 5 and 7 set forth above. *Supra* § III.G.4. For the foregoing reasons, we determine that Petitioner demonstrates by a preponderance of the evidence that claims 12 and 14 are anticipated by Bruning.

#### 7. *Independent Claim 15*

Independent claim 15 is substantially similar to independent claim 1 except that it does not require a user to interact with the claimed switch. Instead, claim 15, recites in part, “wherein (a) or (b) is selectable by switching the switch.” Petitioner cites its showing for independent claim 1 in support of its showing for most limitations. Pet. 49, 53. Petitioner cites additional portions of Bruning to disclose limitations 15.d and 15.e. *Id.*

Petitioner contends that “claim 15 is broader than claim 1 because claim 15 omits ‘user’” and “[t]hus, Bruning *additionally* discloses this limitation by disclosing a switch (color specific switches (Q4, Q5)) capable of (b) switching the at least one additional LED circuit (e.g., LED sub-array circuits 210G and 210B, respectively) on or off.” *Id.* at 49 (citing Ex. 1004 ¶¶ 41–46, Figs. 4, 4b–4d<sup>18</sup>; Ex. 1002 ¶ 105) (emphasis added). Petitioner further contends that “Bruning discloses the LED circuits can be turned on and off independently.” *Id.* at 50 (citing Ex. 1004 ¶¶ 11, 12, 25, 26, 42, 44, 46, Figs. 4, 4b–4d).

Patent Owner addresses independent claims 1, 8, and 15 together, and does not appear to make any arguments that are applicable to only independent claim 15. *See generally* PO Resp. We rely on our analysis set forth in Section III.G.2.

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<sup>18</sup> Bruning includes a Figure 4 as well as Figures 4a, 4b, 4c, and 4d.

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For the foregoing reasons, Petitioner demonstrates by a preponderance of the evidence that claim 15 is anticipated by Bruning.

8. *Dependent Claim 19*

Dependent claim 19 recites features substantially similar to claim 5. Petitioner refers to its showing for dependent claim 5 in support of its showing for dependent 19. We adopt our analysis with respect to claim 5 set forth above. *Supra* § III.G.4. For the foregoing reasons, Petitioner demonstrates by a preponderance of the evidence that claim 19 is anticipated by Bruning.

H. *Challenge 4—Obviousness over Bruning and Kabel*

Petitioner contends that claims 1–3, 5, 7–10, 12, 14–17, and 19 are unpatentable as obvious under 35 U.S.C. § 103 over Bruning and Kabel. Pet. 53–61. For the reasons that follow, we are persuaded that Petitioner demonstrates obviousness of claims 1, 2, 5, 7–9, 12, 14–16, and 19 over Bruning in view of Kabel by a preponderance of the evidence.

1. *Overview of Kabel*

Kabel is titled “Computer Program, Method, and Device for Controlling the Brightness of a Display.” Ex. 1005, code (54) (Title). Kabel relates to “displays used in electronic devices such as laptop computers and avionics and marine equipment” and to “a computer program and method for controlling the brightness of a display by proportionally modifying the luminosity of each pixel in the display.” *Id.* ¶ 3. More particularly, Kabel discloses a technique for controlling the brightness of a display by proportionally varying the voltage delivered to each pixel in the display after a back light for the display has been dimmed to its approximate lowest level. *Id.* at code (57) (Abstract).

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Figure 1 of Kabel, reproduced below, shows an exploded isometric view of a display's components. *Id.* ¶ 14.

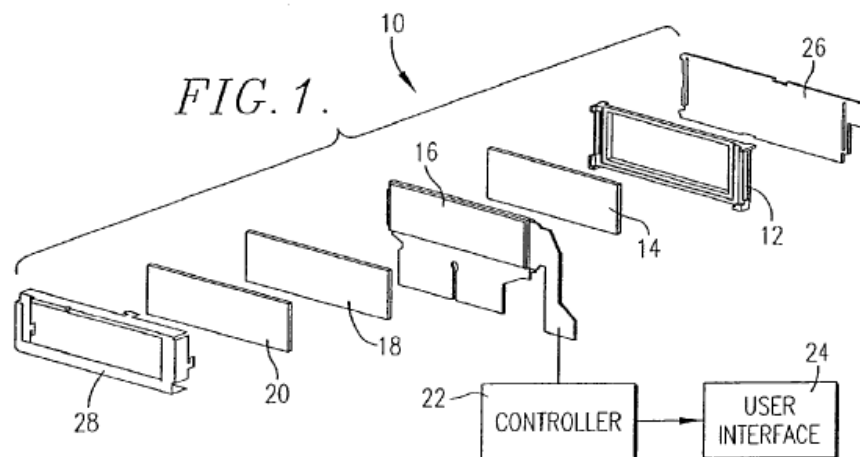


Figure 1 of Kabel, reproduced below, shows an exploded isometric view of the components of a display including a backlight. *Id.* ¶¶ 14, 17–18.

Display 10 illustrated in Kabel's Figure 1 includes: a backlight 12, which may include light-emitting diodes (LEDs), and is used to direct light through a display module 16 to form images on the face thereof; a diffuser panel 14 positioned between backlight 12 and display module 16 for diffusing and uniformly polarizing light emitted from backlight 12; display module 16; a color filter 18 which enables display 10 to display color images; an anti-reflective lens 20 positioned in front of display module 16 and color filter 18, for polarizing light passing through color filter 18 to sharpen images and eliminate glare; a brightness controller 22; and a user interface 24. *Id.* ¶¶ 17–21, 23, 25.

Backlight 12, diffuser panel 14, display module 16, color filter 18, and anti-reflective lens 20 may be sandwiched between a mounting board 26 and a frame 28, while controller 22 and user interface 24 may be integrally mounted with the other components of display 10, or may be mounted in a

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separate enclosure attached to the other components of the display. *Id.* ¶ 18. Display module 16 may be a thin-film transistor (TFT) liquid crystal display (LCD) display module having an array of pixels arranged on a glass substrate, whereby active matrix technology is used to activate each pixel by a separate transistor. *Id.* ¶ 21. An image is then created on display module 16 by applying an electric charge to certain pixels to change the pixels' light absorption properties, to thereby vary the amount of light from backlight 12 that passes through the pixels. *Id.*

Brightness controller 22 and user interface 24 are electrically coupled to display module 16 and together control the brightness of display module 16. *Id.* ¶ 26. User interface 24 provides input to controller 22, and may be a touch-screen menu display having up/down arrows, or a manually-activatable slider bar. *Id.* Controller 22 and user interface 24 are operated to brighten or dim images created on display module 16. *Id.* ¶ 27. For example, an operator may press an up arrow or operate a slider bar on user interface 24 to increase the intensity of backlight 12. *Id.* Controller 22 and user interface 24 cooperate for dimming the display module 16 in two ways: first by dimming backlight 12, then by proportionally reducing the luminosity of the pixels of display module 16. *Id.* ¶ 28. More specifically, display module 16 is first dimmed by decreasing the brightness of backlight 12, and once backlight 12 has been dimmed to its lowest level before it turns off (or to a selected threshold level), the display may then be further dimmed by controlling the luminosity of each pixel of the display to limit the amount of light that passes through display module 16. *Id.*

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## 2. *Independent Claims 1, 8, and 15*

Petitioner’s challenge to independent claims 1, 8, and 15 are substantially similar to challenge 3 applying Bruning alone except that in its fourth challenge Petitioner cites Kabel for the switch limitations—limitations 1.d, 1.e, 8.d, 8.e, 15.d, and 15.e. Petitioner contends that “[u]nder [Patent Owner’s] narrow construction of ‘switch,’ it would have been obvious to implement Bruning’s ‘panel light setting’ switch as a ‘manually-activatable slider bar’ with at least two positions as taught by Kabel.” Pet. 58 (citing Pet. § IX.C (Combination Rationale); Ex. 1002 ¶ 129).

### *Rationale for Combining*

As rationale for combining, Petitioner contends that “a POSITA would have been motivated to investigate known implementation details for the ‘panel light setting,’ and been led to Kabel’s teachings,” which include “a ‘user interface’ for ‘selectively adjusting brightness of the back light.’” Pet. 54 (citing Ex. 1004 ¶ 38, Fig. 4; Ex. 1005, code (57) (Abstract), ¶¶ 9, 26–28, 30; Ex. 1002 ¶ 118). Petitioner further contends that Bruning and Kabel concern analogous art because they both disclose backlit LCD displays having multiple LEDs in a laptop computer, they both disclose “mix[] . . . red, green, and blue light to form different shades and hues of light as perceived by the user,” and they both disclose “ways for a user to control of the LCD display’s brightness.” *Id.* at 54–58.

Petitioner alleges that a POSITA would have “fill[ed] Bruning’s gaps with Kabel’s additional implementation details,” specifically by implementing Bruning’s panel light setting using Kabel’s slider bar. Petitioner contends that Kabel discloses brightening or dimming images on a

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display in a conventional manner—by using Kabel’s slider bar. *Id.* at 56–57 (citing Ex. 1005 ¶¶ 27, 28, 30; Ex. 1002 ¶ 125).

Petitioner contends that the invention disclosed in Kabel includes “an ‘entirely conventional’ backlight that incorporates ‘any conventional light source such as light-emitting diodes (LEDs),’ a ‘conventional’ LCD display, and a ‘conventional controller.’” *Id.* at 57 (citing Ex. 1005 ¶¶ 18, 19, 21, 26). Petitioner further contends that “Kabel also indicates that images on the display can be brightened or dimmed ‘in a conventional manner’ and gives as an example a slider bar.” *Id.* (citing Ex. 1005 ¶¶ 27, 28; Ex. 1027 ¶ 30; Ex. 1002 ¶ 126).

Petitioner further contends that

[a] POSITA would have found that Bruning and Kabel’s teachings could have been predictably combined at least because of LED lighting art’s predictability and the various elements’ known interchangeability. A POSITA would have had a reasonable expectation of success in combining Kabel and Bruning, at least because the references use known variations of existing technology (physical switches like slider bars as user interfaces) to solve routine and well understood problems (adjust settings of a laptop’s display, such as brightness) in predictable ways.

*Id.* at 58 (citing Ex. 1002 ¶ 127).

#### *Patent Owner’s Arguments*

Patent Owner contends that “[n]othing cited in the Petition indicates that Kabel operates by switching voltage levels to LEDs, or by switching LED circuits on or off as required the claims,” and instead, “Kabel uses the slider bar exclusively to provide a dimming function.” PO Resp. 62 (citing Pet. 59–60; Ex. 1005 ¶ 28 (Patent Owner contending that the cited portion of Kabel “explain[s] low brightness settings are achieved by dimming the back

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light 12 ‘to its lowest level before it turns off’”). Patent Owner further contends that “Kabel’s purpose would be frustrated if the back light were completely shut off because vehicles like aircraft and boats would be at risk of accidents if the display lights were entirely shut off.” *Id.* at 63 (citing Ex. 2008 ¶ 33).

*Analysis of Patent Owner’s Arguments and Rationale for Combining*

Patent Owner apparently distinguishes Kabel’s slider bar on the basis that it performs the function of dimming back light 12, as contrasted with the function of turning on or off back light 12. *See* PO Resp. 62–63 (Pet. 59–60; Ex. 1005 ¶ 28). Patent Owner takes the position that, because Kabel “explain[s] low brightness settings are achieved by dimming the back light 12 ‘to its lowest level before it turns off,’” this disclosure in Kabel precludes back light 12 from actually turning off. *Id.* at 62 (quoting Ex. 1005 ¶ 28). Even assuming, *arguendo*, that Kabel does not disclose turning off back light 12, the independent claims only require “a switch cable of *at least one of*: (a) switching a brightness level of at least one of the first operating LED circuit or the at least one additional LED circuit, *or* (b) switching the at least one additional LED circuit on or off, wherein (a) *or* (b) is selectable by a user switching the switch.” That is, the switch need not be capable of both functions (a) and (b)—if the reference or combination of references teaches even one of the following three situations: a switch capable of function (a) only; a switch capable of function (b) only; or a switch capable of functions (a) and (b), then the cited reference(s) teach the subject matter of the claim. Accordingly, even if Kabel’s slider bar is used exclusively for dimming, independent claims 1, 8, and 15 are met by the cited teachings of Bruning and Kabel because the combination teaches claimed function (a).

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We have reviewed Petitioner’s contentions and cited evidence as to claims 1, 8, and 15, summarized above. We are persuaded that the Petition’s obviousness analysis articulates sufficiently how the teachings of Bruning and Kabel would have been combined, why such a combination would have been desirable to one of skill in the art, and that Petitioner’s rationale is supported by sufficient rational underpinning and has a reasonable expectation of success as is set forth above. We are persuaded, having reviewed the cited portions of Bruning and Kabel, the limitations of independent claims 1, 8, and 15 are taught or suggested by the combination.

Based on the current record and for the foregoing reasons, we determine that Petitioner establishes, by a preponderance of the evidence, that independent claims 1, 8, and 15 are unpatentable as obvious in view of the combination of Bruning and Kabel.

3. *Dependent Claims 2, 3, 5, 7, 9, 10, 12, 14, 16, 17, and 19*

With respect to claims 3, 10, and 17, as we discussed above in Section III.G.3, claims 3, 10, and 17 were indefinite under 35 U.S.C. § 112(b) under our adopted definition of “forward voltage” recited in these claims. As we are unable to ascertain the scope of these claims, we cannot reach the merits of Petitioner’s prior art-based challenges to claims 3, 10, and 17.

With respect to claims 2, 5, 7, 9, 12, 14, 16, and 19, we have reviewed Petitioner’s contentions and the cited references, and we are persuaded that Petitioner’s contentions are supported. *See* Pet. 58–61 (citing-in-part Ex. 1002 ¶¶ 134–142, 144–152). Patent Owner does not specifically contest any of claims 2, 5, 7, 9, 12, 14, 16, and 19. *See generally* PO Resp.

Claim 2 recites “[t]he LED lighting device of claim 1, wherein the

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switch has at least two positions.” Claim 9 depends from claim 8 and recites substantially similar features. Claim 16 depends from claim 15 and recites substantially similar features. Petitioner cites Kabel for these limitations and argues that “it would have been obvious to implement the ‘panel light setting’ switch as a ‘manually-activatable slide bar’ with at least two positions as taught by Kabel.” Pet. 60–61. Having reviewed the cited portions of Kabel discussing its slider bar, we are persuaded that Kabel teaches that its “manually-activatable slider bar” has at least two positions.

Claim 5 recites “[t]he LED lighting device of claim 1, wherein the switching of the switch changes light output of the LED lighting device.” Claim 12 depends from claim 8 and recites substantially similar features. Claim 19 depends from claim 15 and recites substantially similar features. Petitioner contends that “Bruning discloses the user can control a ‘panel light setting’ switch that allows adjustment of the brightness, or maximum light output of the LED backlight for a laptop’s display.” Pet. 58 (citing Ex. 1004 ¶¶ 17, 38, Figs. 2, 4). Petitioner alternatively contends that Kabel “discloses the user can control user interface 24 to adjust brightness of the laptop display’s backlight.” *Id.* at 59–60 (citing Ex. 1005 ¶¶ 9, 18, 26–32, code (57) (Abstract), Fig. 1; Ex. 1002 ¶ 131). Petitioner further contends that “Kabel discloses that the user interface 24 may be a ‘manually-activatable slider bar’” and that user interface 24 may be “integrally mounted with the other components of the display 10.” *Id.* at 60 (citing Ex. 1005 ¶¶ 18, 26, 30). We are persuaded that the cited portions support Petitioner’s contentions.

Claim 7 recites, “[t]he LED lighting device of claim 1, further

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comprising a driver electrically coupled to the switch and at least one of the first operating LED circuit or the at least one additional LED circuit.” Claim 14 depends from claim 8 and recites substantially similar features. In its fourth challenge, Petitioner does not specifically point to Kabel as teaching the recited driver limitation. Pet. 58–59. We note, however, that with respect to its third challenge, Petitioner persuasively cites Bruning to disclose the recited driver limitation. *See id.* at 44–46 (citing Ex. 1004 ¶¶ 13, 31–44, code (57) (Abstract), Figs. 3–4; Pet. § V.E.5; Ex. 1002 ¶¶ 86–88); *supra* § III.G.4.

Based on the complete record developed during trial and for the foregoing reasons, that Petitioner establishes, by a preponderance of the evidence, that dependent claims 2, 5, 7, 9, 12, 14, 16, and 19 are unpatentable as obvious in view of Bruning and Kabel.

*I. Challenge 5—Obviousness over Dowling and Mueller*

Petitioner contends that claims 1, 2, 5, 7–9, 12, 14–16, and 19 are unpatentable as obvious under 35 U.S.C. § 103 over Dowling and Mueller. Pet. 61–83.

As we determine that claims 3, 4, 10, 11, 17, and 18 are unpatentable under 35 U.S.C. § 112, that claims 1, 5, 7, 8, 12, 14, 15, and 19 are anticipated under 35 U.S.C. § 102 by Bruning, and that claims 1, 2, 5, 7–9, 12, 14–16, and 19 are unpatentable under 35 U.S.C. § 103(a) over the combination of Bruning and Kabel (*supra* §§ II.D–E, G–H), we need not specifically determine the unpatentability of claims 1, 2, 5, 7–9, 12, 14–16, and 19 over the combination of Dowling and Mueller. *See Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984 (Fed. Cir. 2020); *see also Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (holding

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that once a dispositive issue is decided, there is no need to decide other issues).

#### IV. CONCLUSION<sup>19</sup>

In summary:

<b>Claims Challenged</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/ Basis</b>	<b>Claims Shown Unpatentable</b>	<b>Claims Not Shown Unpatentable</b>
3, 10, 17	112(a)	Lack of written description, Lack of enablement	3, 10, 17	
3, 10, 17	112(b)	Indefiniteness	3, 10, 17	
4, 11, 18	112(a)	Lack of written description, Lack of enablement	4, 11, 18	
4, 11, 18	112(b)	indefiniteness	4, 11, 18	
1, 3, 5, 7, 8, 10, 12, 14, 15, 17, 19	102	Bruning	1, 5, 7, 8, 12, 14, 15, 19 <sup>20</sup>	
1–3, 5, 7–10, 12, 14–17, 19	103	Bruning, Kabel	1, 2, 5, 7–9, 12, 14–16, 19 <sup>20</sup>	
1, 2, 5, 7–9, 12, 14–16, 19	103	Dowling,		

<sup>19</sup> Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

<sup>20</sup> As we are unable to ascertain the scope of these claims, we cannot reach the merits of Petitioner's prior art-based challenges to claims 3, 10, and 17.

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<b>Claims Challenged</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/ Basis</b>	<b>Claims Shown Unpatentable</b>	<b>Claims Not Shown Unpatentable</b>
		Mueller <sup>21</sup>		
<b>Overall Outcome</b>			1–5, 7–12, 14–19	

## V. ORDER

For the reasons given, it is:

ORDERED that Petitioner has established based on a preponderance of evidence that claims 1–5, 7–12, and 14–19 of the '341 patent are unpatentable; and

FURTHER ORDERED because this is a final written decision, the parties to this proceeding seeking judicial review of our Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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<sup>21</sup> Because we determined that the challenged claims are unpatentable under 35 U.S.C. § 112, unpatentable as anticipated under 35 U.S.C. § 102 by Bruning, or unpatentable under 35 U.S.C. § 103 as obvious over the combination of Bruning and Kabel, we decline to address this ground.

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Patent 10,932,341 B2

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US010932341B2

(12) **United States Patent**  
**Miskin et al.**

(10) **Patent No.:** **US 10,932,341 B2**

(45) **Date of Patent:** **\*Feb. 23, 2021**

(54) **MULTI-VOLTAGE AND  
MULTI-BRIGHTNESS LED LIGHTING  
DEVICES AND METHODS OF USING SAME**

(56) **References Cited**

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(71) Applicant: **Lynk Labs, Inc.**, Elgin, IL (US)

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(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **16/740,295**

*Primary Examiner* — Crystal L Hammond

(74) *Attorney, Agent, or Firm* — K&L Gates LLP

(22) Filed: **Jan. 10, 2020**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2020/0260554 A1 Aug. 13, 2020

A single chip multi-voltage or multi-brightness LED lighting device having at least two LED circuits. Each of the at least two LED circuits having at least two LEDs connected together in series. Each of the at least two LED circuits are electrically unconnected to each other in a parallel relationship, have a forward operating drive voltage of at least six volts and are monolithically integrated on a single substrate. A method of manufacturing a single chip with two or more LED circuits configurable by means of connecting the circuits so as to provide optional operating voltage level and/or desired brightness level wherein the electrical connection may be achieved and/or completed at the LED packaging level when the single chips are integrated into the LED package. Alternatively, the LED package may have external electrical contacts that match the integrated chips within. Optionally allowable, the drive voltage level and/or the brightness level select-ability may be passed on through to the exterior of the LED package and may be selected by the LED package user, the PCB assembly facility, or the end product manufacturer.

**Related U.S. Application Data**

(63) Continuation of application No. 16/274,164, filed on  
Feb. 12, 2019, now Pat. No. 10,537,001, which is a  
(Continued)

(51) **Int. Cl.**  
**H05B 45/40** (2020.01)  
**H05B 45/00** (2020.01)

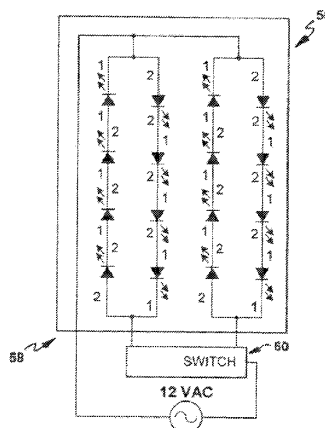
(52) **U.S. Cl.**  
CPC ..... **H05B 45/40** (2020.01); **H05B 45/00**  
(2020.01); **Y10T 29/49002** (2015.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

**20 Claims, 8 Drawing Sheets**



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continuation of application No. 15/685,429, filed on Aug. 24, 2017, now Pat. No. 10,271,393, which is a continuation of application No. 14/172,644, filed on Feb. 4, 2014, now Pat. No. 9,750,098, which is a continuation of application No. 13/322,796, filed as application No. PCT/US2010/001597 on May 28, 2010, now Pat. No. 8,648,539, which is a continuation-in-part of application No. 12/287,267, filed on Oct. 6, 2008, now Pat. No. 8,179,055.

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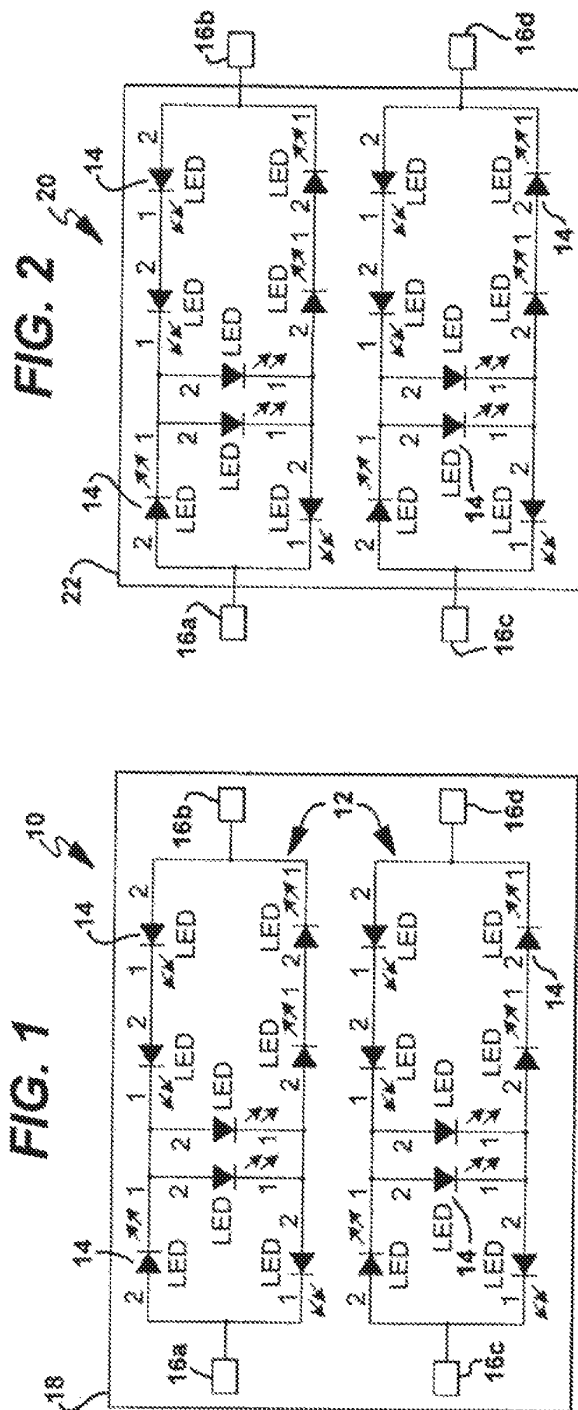
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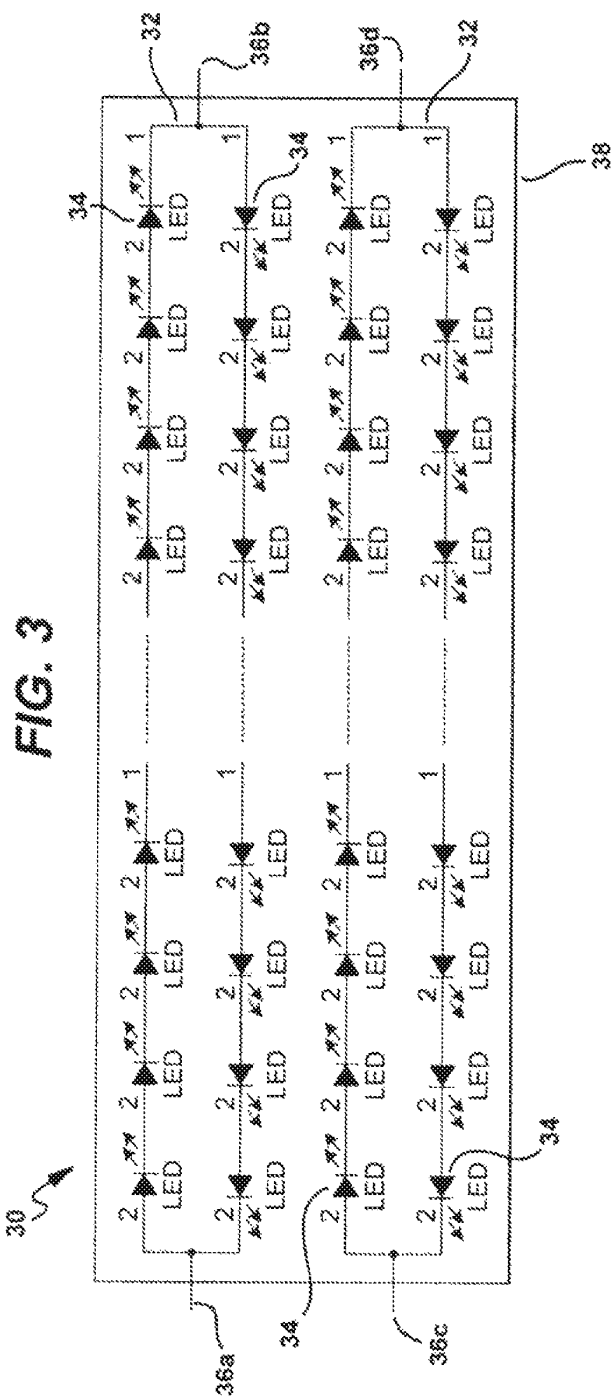


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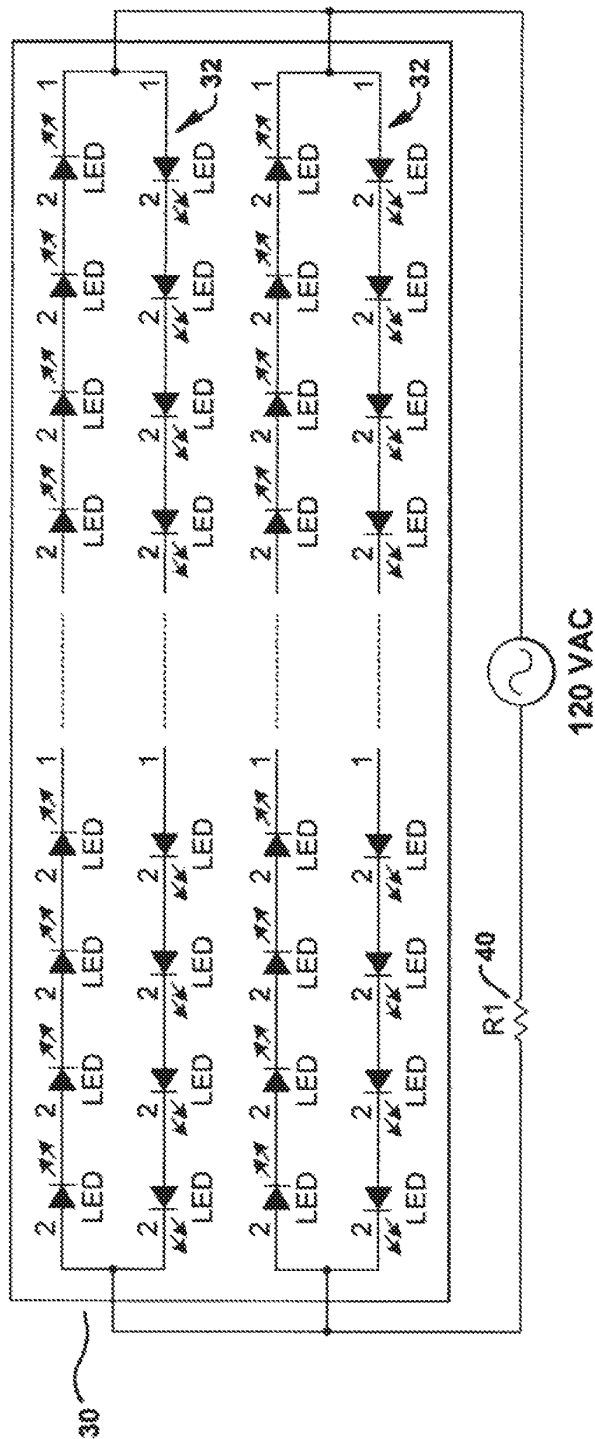
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FIG. 4

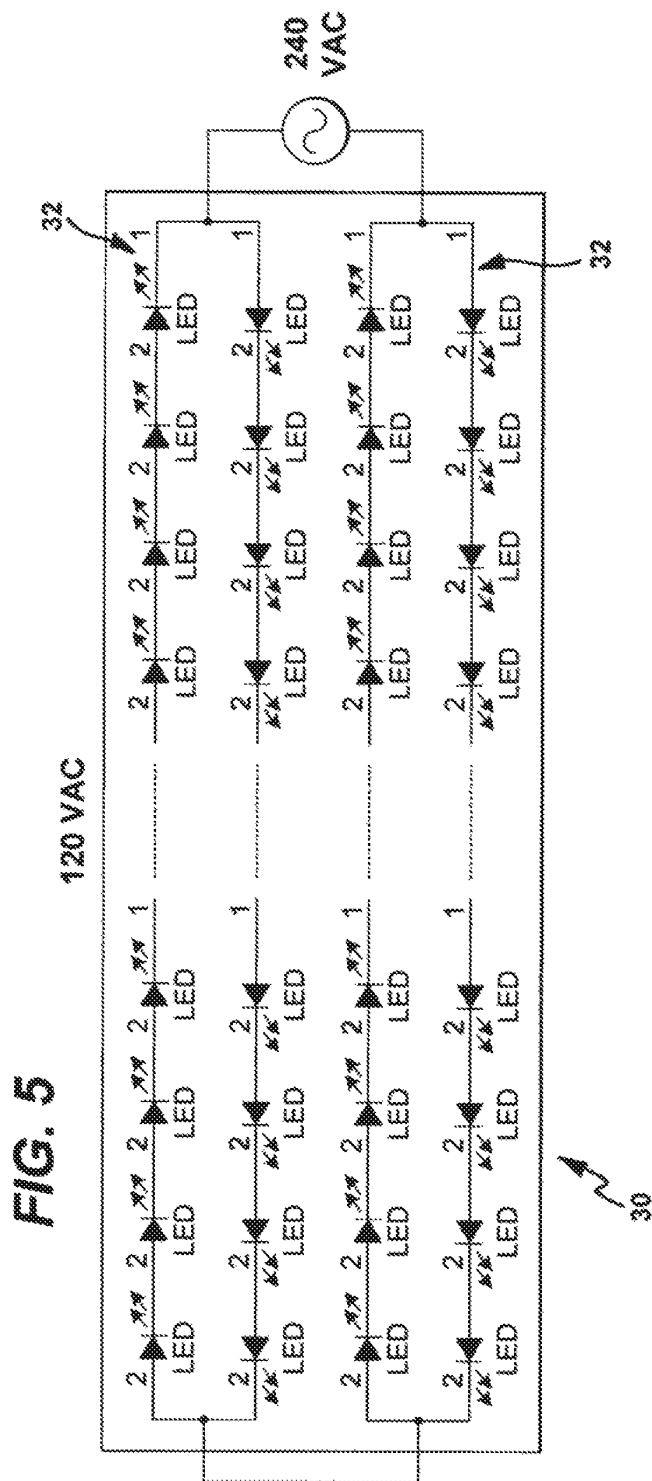


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FIG. 6

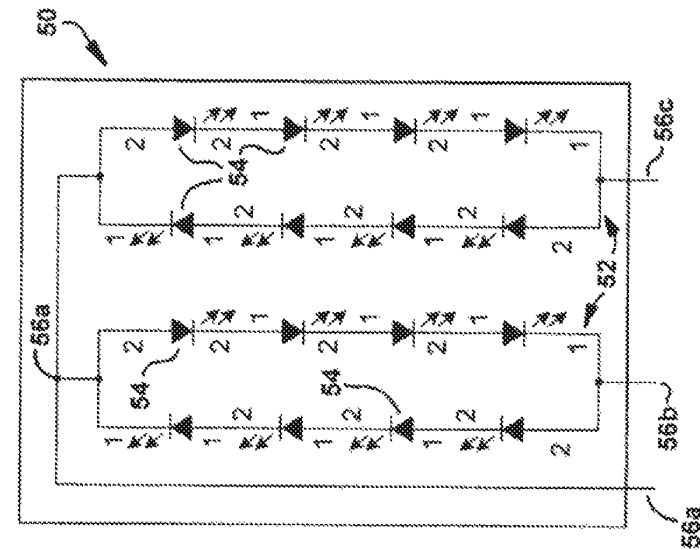
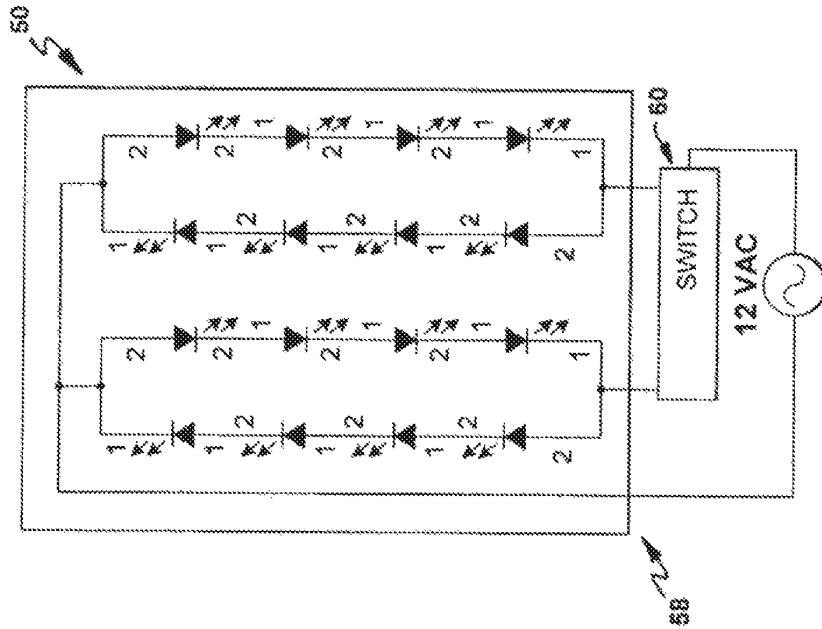


FIG. 7



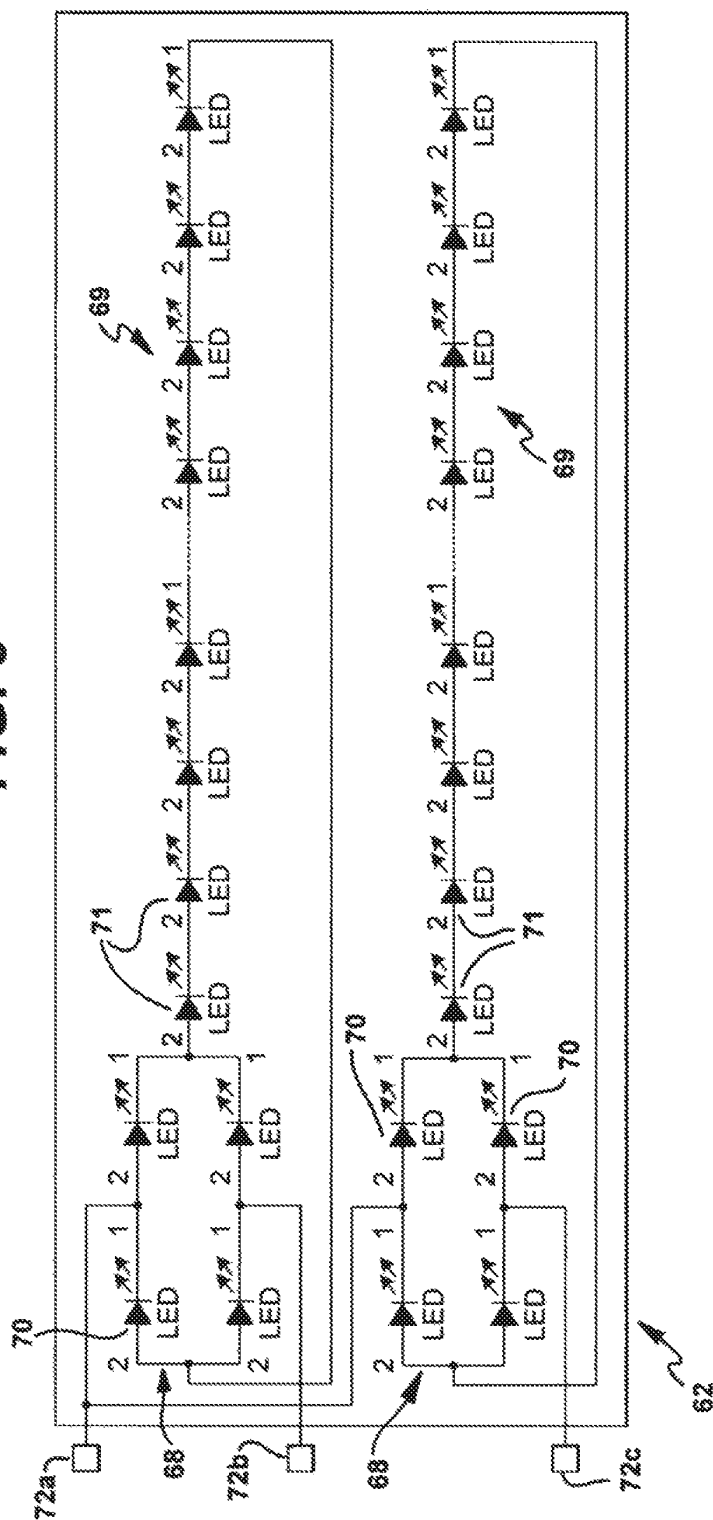
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FIG. 8



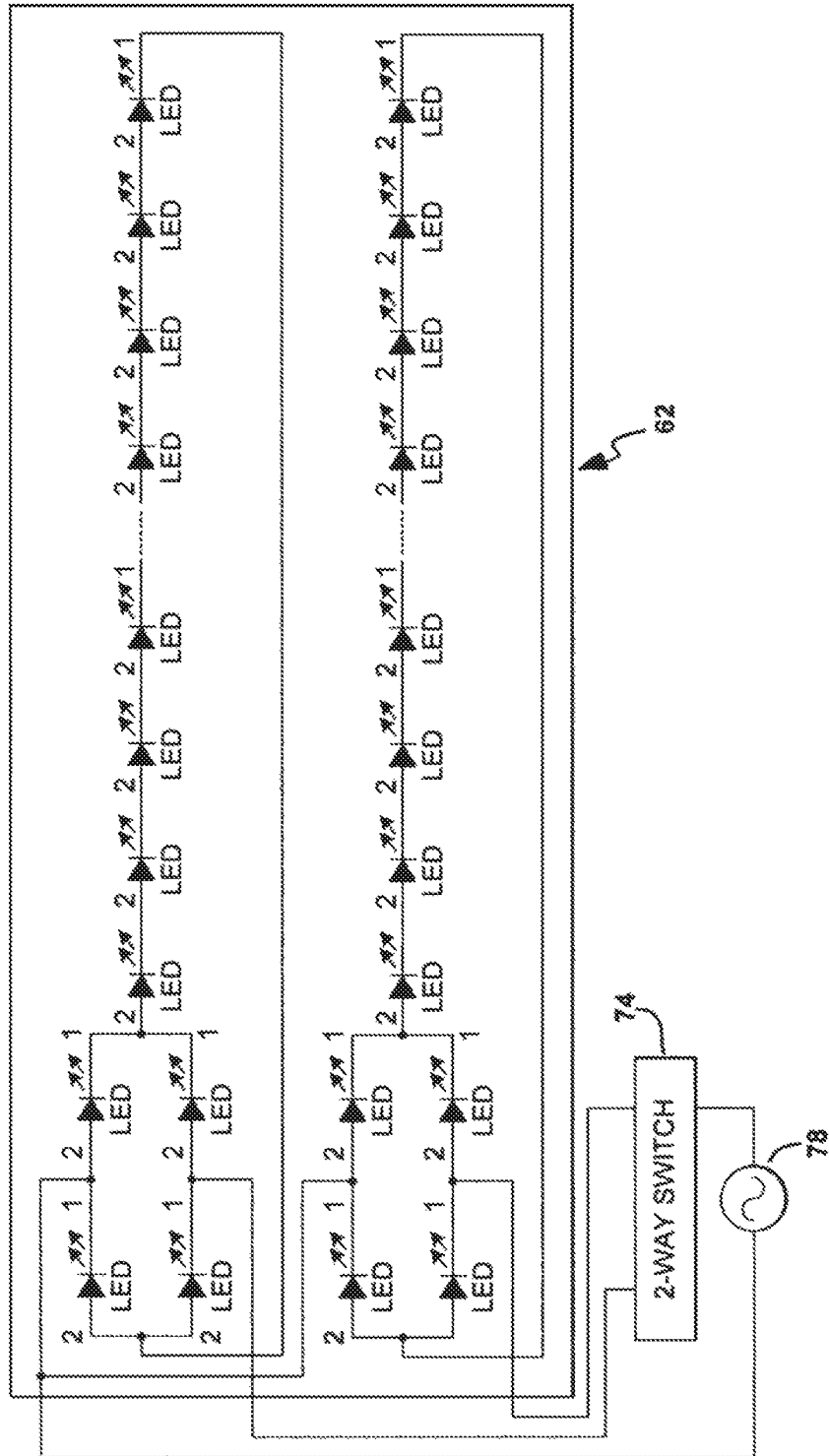
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FIG. 9



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FIG. 10

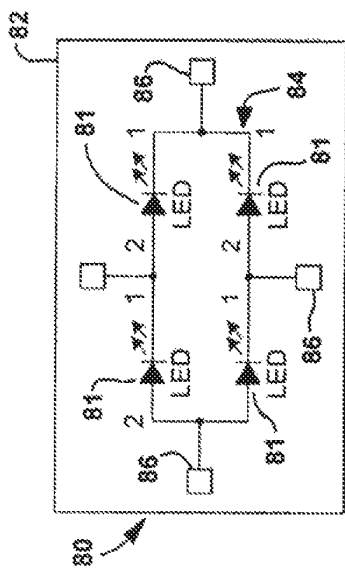


FIG. 11

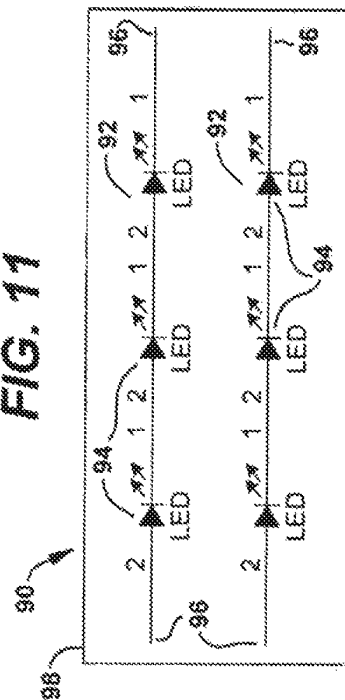
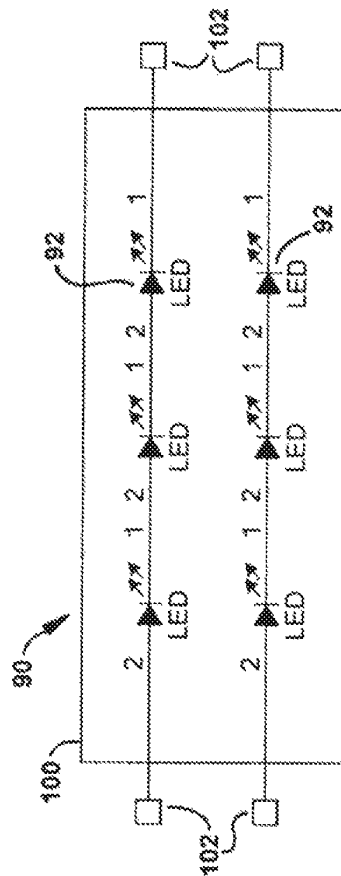


FIG. 12



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# **MULTI-VOLTAGE AND MULTI-BRIGHTNESS LED LIGHTING DEVICES AND METHODS OF USING SAME**

## **RELATED APPLICATIONS**

The present application is a continuation of U.S. patent application Ser. No. 16/274,164, filed Feb. 12, 2019, which is a continuation of U.S. patent application Ser. No. 15/685,429, filed Aug. 24, 2017, which is a continuation of U.S. patent application Ser. No. 14/172,644, filed Feb. 4, 2014, which is a continuation of U.S. patent application Ser. No. 13/322,796, filed Nov. 28, 2011, which is a national phase application of International Application No. PCT/US2010/001597, filed May 28, 2010, which claims priority to U.S. Provisional Application No. 61/217,215, filed May 28, 2009, and is a continuation-in-part of U.S. patent application Ser. No. 12/287,267, filed Oct. 6, 2008, which claims the priority to U.S. Provisional Application No. 60/997,771, filed Oct. 6, 2007; the contents of each of these applications are expressly incorporated herein by reference.

## **TECHNICAL FIELD**

The present invention generally relates to light emitting diodes ("LEDs") for AC operation. The present invention specifically relates to multiple voltage level and multiple brightness level LED devices, packages and lamps.

## **FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT**

None.

## **BACKGROUND OF THE INVENTION**

### **Field of the Invention**

The present invention generally relates to light emitting diodes ("LEDs") for multi-voltage level and/or multi-brightness level operation. The present invention specifically relates to multiple voltage level and multiple brightness level light emitting diode circuits, single chips, packages and lamps "devices" for direct AC voltage power source operation, bridge rectified AC voltage power source operation or constant DC voltage power source operation.

### **Description of the Related Art**

LEDs are semiconductor devices that produce light when a current is supplied to them. LEDs are intrinsically DC devices that only pass current in one polarity and historically have been driven by DC voltage sources using resistors, current regulators and voltage regulators to limit the voltage and current delivered to the LED. Some LEDs have resistors built into the LED package providing a higher voltage LED typically driven with 5V DC or 12V DC.

With proper design considerations LEDs may be driven more efficiently with direct AC or rectified AC than with constant voltage or constant current DC drive schemes.

Some standard AC voltage in the world include 12 VAC, 24 VAC, 100 VAC, 110 VAC, 120 VAC, 220 VAC, 230 VAC, 240 VAC and 277 VAC. Therefore, it would be advantageous to have a single chip LED or multi-chip single LED packages that could be easily configured to operate at multiple voltages by simply selecting a voltage and/or current level when packaging the multi-voltage and/or

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multi-current single chip LEDs or by selecting a specific voltage and/or current level when integrating the LED package onto a printed circuit board or within a finished lighting product. It would also be advantageous to have multi-current LED chips and/or packages for LED lamp applications in order to provide a means of increasing brightness in LED lamps by switching in additional circuits just as additional filaments are switched in for standard incandescent lamps.

U.S. Pat. No. 7,525,248 discloses a chip-scale LED lamp including discrete LEDs capable of being built upon electrically insulative, electrically conductive, or electrically semi conductive substrates. Further, the construction of the LED lamp enables the lamp to be configured for high voltage AC or DC power operation. The LED based solid-state light emitting device or lamp is built upon an electrically insulating layer that has been formed onto a support surface of a substrate. Specifically, the insulating layer may be epitaxially grown onto the substrate, followed by an LED buildup of an n-type semiconductor layer, an optically active layer, and a p-type semiconductor layer, in succession. Isolated mesa structure of individual, discrete LEDs is formed by etching specific portions of the LED buildup down to the insulating layer, thereby forming trenches between adjacent LEDs. Thereafter, the individual LEDs are electrically coupled together through conductive elements or traces being deposited for connecting the n-type layer of one LED and the p-type layer of an adjacent LED, continuing across all of the LEDs to form the solid-state light emitting device. The device may therefore be formed as an integrated AC/DC light emitter with a positive and negative lead for supplied electrical power. For instance, the LED lamp may be configured for powering by high voltage DC power (e.g., 12V, 24V, etc.) or high voltage AC power (e.g., 110/120V, 220/240V, etc.).

U.S. Pat. No. 7,213,942 discloses a single-chip LED device through the use of integrated circuit technology, which can be used for standard high AC voltage (110 volts for North America, and 220 volts for Europe, Asia, etc.) operation. The single-chip AC LED device integrates many smaller LEDs, which are connected in series. The integration is done during the LED fabrication process and the final product is a single-chip device that can be plugged directly into house or building power outlets or directly screwed into incandescent lamp sockets that are powered by standard AC voltages. The series connected smaller LEDs are patterned by photolithography, etching (such as plasma dry etching), and metallization on a single chip. The electrical insulation between small LEDs within a single-chip is achieved by etching light emitting materials into the insulating substrate so that no light emitting material is present between small LEDs. The voltage crossing each one of the small LEDs is about the same as that in a conventional DC operating LED fabricated from the same type of material (e.g., about 3.5 volts for blue LEDs).

Accordingly, single chip LEDs have been limited and have not been integrated circuits beyond being fixed series or fixed parallel circuit configurations until the development of AC LEDs. The AC LEDs have still however been single circuit, fixed single voltage designs.

LED packages have historically not been integrated circuits beyond being fixed series or fixed parallel circuit configurations.

The art is deficient in that it does not provide a multi-voltage and/or multi-current circuit monolithically integrated on a single substrate which would be advantageous.

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It would further be advantageous to have a multi-voltage and/or multi-brightness circuit that can provide options in voltage level, brightness level and/or AC or DC powering input power preference.

It would further be advantageous to provide multiple voltage level and/or multiple brightness level light emitting LED circuits, chips, packages and lamps "multi-voltage and/or multi-brightness LED devices" that can easily be electrically configured for at least two forward voltage drive levels with direct AC voltage coupling, bridge rectified AC voltage coupling or constant voltage DC power source coupling. This invention comprises circuits and devices that can be driven with more than one AC or DC forward voltage "multi-voltage" at 6V or greater based on a selectable desired operating voltage level that is achieved by electrically connecting the LED circuits in a series or parallel circuit configuration and/or more than one level of brightness "multi-brightness" based on a switching means that connects and/or disconnects at least one additional LED circuit to and/or from a first LED circuit. The desired operating voltage level and/or the desired brightness level electrical connection may be achieved and/or completed at the LED packaging level when the multi-voltage and/or multi-brightness circuits and/or single chips are integrated into the LED package, or the LED package may have external electrical contacts that match the integrated multi-voltage and/or multi-brightness circuits and/or single chips within, thus allowing the drive voltage level and/or the brightness level select-ability to be passed on through to the exterior of the LED package and allowing the voltage level or brightness level to be selected at the LED package user, or the PCB assembly facility, or the end product manufacturer.

It would further be advantageous to provide at least two integrated circuits having a forward voltage of at least 12 VAC or 12 VDC or greater on a single chip or within a single LED package that provide a means of selecting a forward voltage when packaging a multi-voltage and/or multi-brightness circuit using discrete die (one LED chip at a time) and wire bonding them into a circuit at the packaging level or when packaging one or more multi-voltage and/or multi-brightness level single chips within a LED package.

It would further be advantageous to provide multi-voltage and/or multi-brightness level devices that can provide electrical connection options for either AC or DC voltage operation at preset forward voltage levels of 6V or greater.

It would further be advantageous to provide multi-brightness LED devices that can be switched to different levels of brightness by simply switching additional circuits on or off in addition to a first operating circuit within a single chip and or LED package. This would allow LED lamps to switch to higher brightness levels just like 2-way or 3-way incandescent lamps do today.

The benefits of providing multi-voltage circuits of 6V or greater on a single chip is that an LED packager can use this single chip as a platform to offer more than one LED packaged product with a single chip that addresses multiple voltage levels for various end customer design requirements. This also increase production on a single product for the chip maker and improves inventory control. This also improves buying power and inventory control for the LED packager when using one chip.

The present invention provides for these advantages and solves the deficiencies in the art.

#### SUMMARY OF THE INVENTION

According to one aspect of the invention at least two single voltage AC LED circuits are formed on a single chip

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or on a substrate providing a multi-voltage AC LED device for direct AC power operation. Each single voltage AC LED circuit has at least two LEDs connected to each other in opposing parallel relation.

According to another aspect of the invention, each single voltage AC LED circuit is designed to be driven with a predetermined forward voltage of at least 6 VAC and preferably each single voltage AC LED circuit has a matching forward voltage of 6 VAC, 12 VAC, 24 VAC, 120 VAC, or other AC voltage levels for each single voltage AC LED circuit.

According to another aspect of the invention, each multi-voltage AC LED device would be able to be driven with at least two different AC forward voltages resulting in a first forward voltage drive level by electrically connecting the two single voltage AC LED circuits in parallel and a second forward voltage drive level by electrically connecting the at least two single voltage level AC LED circuits in series. By way of example, the second forward voltage drive level of the serially connected AC LED circuits would be approximately twice the level of the first forward voltage drive level of the parallel connected AC LED circuits. The at least two parallel connected AC LED circuits would be twice the current of the at least two serially connected AC LED circuits. In either circuit configuration, the brightness would be approximately the same with either forward voltage drive selection of the multi-voltage LED device.

According to another aspect of the invention, at least two single voltage series LED circuits, each of which have at least two serially connected LEDs, are formed on a single chip or on a substrate providing a multi-voltage AC or DC operable LED device.

According to another aspect of the invention, each single voltage series LED circuit is designed to be driven with a predetermined forward voltage of at least 6V AC or DC and preferably each single voltage series LED circuit has a matching forward voltage of 6V, 12V, 24V, 120V, or other AC or DC voltage levels. By way of example, each multi-voltage AC or DC LED device would be able to be driven with at least two different AC or DC forward voltages resulting in a first forward voltage drive level by electrically connecting the two single voltage series LED circuits in parallel and a second forward voltage drive level by electrically connecting the at least two single voltage level series LED circuits in series. The second forward voltage drive level of the serially connected series LED circuits would be approximately twice the level of the first forward voltage drive level of the parallel connected series LED circuits. The at least two parallel connected series LED circuits would be twice the current of the at least two serially connected series LED circuits. In either circuit configuration, the brightness would be approximately the same with either forward voltage drive selection of the multi-voltage series LED device.

According to another aspect of the invention, at least two single voltage AC LED circuits are formed on a single chip or on a substrate providing a multi-voltage and/or multi-brightness AC LED device for direct AC power operation.

According to another aspect of the invention, each single voltage AC LED circuit has at least two LEDs connected to each other in opposing parallel relation. Each single voltage AC LED circuit is designed to be driven with a predetermined forward voltage of at least 6 VAC and preferably each single voltage AC LED circuit has a matching forward voltage of 6 VAC, 12 VAC, 24 VAC, 120 VAC, or other AC voltage levels for each single voltage AC LED circuit. The at least two AC LED circuits within each multi-voltage and/or multi current AC LED device would be left able to be

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driven with at least two different AC forward voltages resulting in a first forward voltage drive level by electrically connecting the two single voltage AC LED circuits in parallel and a second forward voltage drive level by electrically connecting the at least two single voltage level AC LED circuits in series. The second forward voltage drive level of the serially connected AC LED circuits would be approximately twice the level of the first forward voltage drive level of the parallel connected AC LED circuits. The at least two parallel connected AC LED circuits would be twice the current of the at least two serially connected AC LED circuits. In either circuit configuration, the brightness would be approximately the same with either forward voltage drive selection of the multi-voltage LED device.

According to another aspect of the invention at least two single voltage LED circuits are formed on a single chip or on a substrate, and at least one bridge circuit made of LEDs is formed on the same single chip or substrate providing a multi-voltage and/or multi-brightness LED device for direct DC power operation. Each single voltage LED circuit has at least two LEDs connected to each other in series. Each single voltage LED circuit is designed to be driven with a predetermined forward voltage and preferably matching forward voltages for each circuit such as 12 VDC, 24 VDC, 120 VDC, or other DC voltage levels for each single voltage LED circuit. Each multi-voltage and/or multi-brightness LED device would be able to be driven with at least two different DC forward voltages resulting in a first forward voltage drive level when the two single voltage LED circuits are connected in parallel and a second forward voltage drive level that is twice the level of the first forward voltage drive level when the at least two LED circuits are connected in series.

According to another aspect of the invention at least two single voltage LED circuits are formed on a single chip or on a substrate providing a multi-voltage and/or multi-brightness LED device for direct DC power operation. Each single voltage LED circuit has at least two LEDs connected to each other in series. Each single voltage LED circuit is designed to be driven with a predetermined forward voltage and preferably matching forward voltages for each circuit such as 12 VAC, 24 VAC, 120 VAC, or other DC voltage levels for each single voltage LED circuit. Each multi-voltage and/or multi-brightness LED device would be able to be driven with at least two different DC forward voltages resulting in a first forward voltage drive level when the two single voltage LED circuits are connected in parallel and a second forward voltage drive level that is twice the level of the first forward voltage drive level when the at least two LED circuits are connected in series.

According to another aspect of the invention at least two single voltage LED circuits are formed on a single chip or on a substrate, and at least one bridge circuit made of LEDs is formed on the same single chip or substrate providing a multi-voltage and/or multi-brightness LED device for direct DC power operation. Each single voltage LED circuit has at least two LEDs connected to each other in series. Each single voltage LED circuit is designed to be driven with a predetermined forward voltage and preferably matching forward voltages for each circuit such as 12 VDC, 24 VDC, 120 VDC, or other DC voltage levels for each single voltage LED circuit. Each multi-voltage and/or multi-brightness LED device would be able to be driven with at least two different DC forward voltages resulting in a first forward voltage drive level when the two single voltage LED circuits are connected in parallel and a second forward voltage drive

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level that is twice the level of the first forward voltage drive level when the at least two LED circuits are connected in series.

According to another aspect of the invention a multi-voltage and/or multi-current AC LED circuit is integrated within a single chip LED. Each multi-voltage and/or multi-current single chip AC LED comprises at least two single voltage AC LED circuits. Each single voltage AC LED circuit has at least two LEDs in anti-parallel configuration to accommodate direct AC voltage operation. Each single voltage AC LED circuit may have at least one voltage input electrical contact at each opposing end of the circuit or the at least two single voltage AC LED circuits may be electrically connected together in series on the single chip and have at least one voltage input electrical contact at each opposing end of the two series connected single voltage AC LED circuits and one voltage input electrical contact at the center junction of the at least two single voltage AC LED circuits connected in series. The at least two single voltage AC LED circuits are integrated within a single chip to form a multi-voltage and/or multi-current single chip AC LED.

According to another aspect of the invention, at least one multi-voltage and/or multi-brightness LED devices may be integrated within a LED lamp. The at least two individual LED circuits within the multi-voltage and/or multi-brightness LED device(s) may be wired in a series or parallel circuit configuration by the LED packager during the LED packaging process thus providing for at least two forward voltage drive options, for example 12 VAC and 24 VAC or 120 VAC and 240 VAC that can be selected by the LED packager.

According to another aspect of the invention a multi-voltage and/or multi-current AC LED package is provided, comprising at least one multi-voltage and/or multi-current single chip AC LED integrated within a LED package. The multi-voltage and/or multi-current AC LED package provides matching electrical connectivity pads on the exterior of the LED package to the electrical connectivity pads of the at least one multi-voltage and/or multi-current single chip AC LED integrated within the LED package thus allowing the LED package user to wire the multi-voltage and/or multi-current AC LED package into a series or parallel circuit configuration during the PCB assembly process or final product integration process and further providing a AC LED package with at least two forward voltage drive options.

According to another aspect of the invention multiple individual discrete LED chips are used to form at least one multi-voltage and/or multi-current AC LED circuit within a LED package thus providing a multi-voltage and/or multi-current AC LED package. Each multi-voltage and/or multi-current AC LED circuit within the package comprises at least two single voltage AC LED circuits. Each single voltage AC LED circuit has at least two LEDs in anti-parallel configuration to accommodate direct AC voltage operation. The LED package provides electrical connectivity pads on the exterior of the LED package that match the electrical connectivity pads of the at least two single voltage AC LED circuits integrated within the multi-voltage and/or multi-current AC LED package thus allowing the LED package to be wired into a series or parallel circuit configuration during the PCB assembly process and further providing a LED package with at least two forward voltage drive options.

According to another aspect of the invention a multi-voltage and/or multi-current single chip AC LED and/or multi-voltage and/or multi current AC LED package is

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integrated within an LED lamp. The LED lamp having a structure that comprises a heat sink, a lens cover and a standard lamp electrical base. The multi-voltage and/or multi-current single chip AC LED and/or package is configured to provide a means of switching on at least one additional single voltage AC LED circuit within multi-voltage and/or multi-current AC LED circuit to provide increased brightness from the LED lamp.

According to another broad aspect of the invention at least one multi-current AC LED single chip is integrated within a LED package.

According to another aspect of the invention, at least one single chip multi-current LED bridge circuit is integrated within a LED lamp having a standard lamp base. The single chip multi-current LED bridge circuit may be electrically connected together in parallel configuration but left open to accommodate switching on a switch to the more than one on the single chip and have at least one accessible electrical contact at each opposing end of the two series connected circuits and one accessible electrical contact at the center junction of the at least two individual serially connected LED circuits. The at least two individual circuits are integrated within a single chip.

According to another aspect of the invention. When the at least two circuits are left unconnected on the single chip and provide electrical pads for connectivity during the packaging process, the LED packager may wire them into series or parallel connection based on the desired voltage level specification of the end LED package product offering.

According to another broad aspect of the invention a multi-brightness single chip AC LED is provided having at least two LED circuits. Each LED circuit has at least two diodes connected to each other in opposing parallel relation, at least one of which such diodes is an LED thus forming an AC LED circuit that is integrated on a single chip. Each LED circuit within the multi-brightness single chip AC LED is designed to be driven in parallel with the same matching forward voltage such as 12 VAC, 24 VAC, 120 VAC, or other AC voltages level. Each multi-brightness single chip AC LED is designed to operate on at least one single circuit integrated within the multi-brightness single chip AC LED. The multi-brightness single chip AC LED operates on a switch having at least two positions each of which is connected to at least one circuit within the multi-brightness single chip AC LED.

It should be noted that "package" or "packaged" is defined herein as an integrated unit meant to be used as a discrete component in either of the manufacture, assembly, installation, or modification of an LED lighting device or system. Such a package includes LED's of desired characteristics with capacitors and or resistors sized relative to the specifications of the chosen opposing parallel LED's to which they will be connected in series and with respect to a predetermined AC voltage and frequency.

Preferred embodiments of a package may include an insulating substrate whereon the LEDs, capacitors and or resistors are formed or mounted. In such preferred embodiments of a package the substrate will include electrodes or leads for uniform connection of the package to a device or system associated with an AC driver or power source. The electrodes, leads, and uniform connection may include any currently known means including mechanical fit, and/or soldering. The substrate may be such as sapphire, silicon carbide, gallium nitride, ceramics, printed circuit board material, or other materials for hosting circuit components.

A package in certain applications may preferably also include a heat sink, a reflective material, a lens for directing

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light, phosphor, nano-crystals or other light changing or enhancing substances. In sum, according to one aspect of the invention, the LED circuits and AC drivers of the present invention permit pre-packaging of the LED portion of a lighting system to be used with standardized drivers of known specified voltage and frequency output. Such packages can be of varied make up and can be combined with each other to create desired systems given the scalable and compatible arrangements possible with, and resulting from, the invention.

According to one aspect of the invention, AC driven LED circuits (or "driven circuits") permit or enable lighting systems where LED circuits may be added to or subtracted (either by choice or by way of a failure of a diode) from the driven circuit without significantly affecting the pre-determined desired output range of light from any individual LED and, without the need to: (i) change the value of any discrete component; or, (ii) to add or subtract any discrete components, of any of the pre-existing driven circuit components which remain after the change. During design of a lighting system, one attribute of the LEDs chosen will be the amount of light provided during operation. In this context, it should be understood that depending on the operating parameters of the driver chosen, the stability or range of the voltage and frequency of the driver will vary from the nominal specification based upon various factors including but not limited to, the addition or subtraction of the LED circuits to which it becomes connected or disconnected. Accordingly, as sometimes referred to herein, drivers according to the invention are described as providing "relatively constant" or "fixed" voltage and frequency. The extent of this relative range may be considered in light of the acceptable range of light output desired from the resulting circuit at the before, during, or after a change has been made to the lighting system as a whole. Thus it will be expected that a pre-determined range of desired light output will be determined within which the driven LED circuits of the invention will perform whether or not additional or different LED circuits have been added or taken out of the driven circuit as a whole.

According to an aspect of the invention, an LED circuit driver provides a relatively fixed voltage and relatively fixed frequency AC output such as mains power sources. The LED circuit driver output voltage and frequency delivered to the LED circuit may be higher or lower than mains power voltage and frequencies by using an LED circuit inverter driver.

The higher frequency LED circuit inverter driver may be an electronic transformer, halogen or high intensity discharge (HID) lamp type driver with design modifications for providing a relatively fixed voltage as the LED circuit load changes. Meaning if the LED circuit inverter driver is designed to have an output voltage of 12V LED circuit driver would provide this output as a relatively constant output to a load having one or more than one LED circuits up to the wattage limit of the LED circuit driver even if LED circuits were added to or removed from the output of the LED circuit driver.

The higher frequency inverter having a relatively fixed voltage allows for smaller components to be used and provides a known output providing a standard reference High Frequency LED circuit driver.

Prior art for single chip LED circuits, for example those disclosed in 02004023568 and JP2004006582 do not provide a way to reduce the number of LEDs within the chip below the total forward voltage drop requirements of the source. The present invention however, enables an LED

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circuit to be made with any number of LEDs within a single chip, package or module by using capacitors or RC networks to reduce the number of LEDs needed to as few as one single LEO. Improved reliability, integration, product and system scalability and solid state lighting design simplicity may be realized with LED circuits and the LED circuit drivers. Individual LED circuits being the same or different colors, each requiring different forward voltages and currents may be driven from a single source LED circuit driver. Each individual LED circuit can self-regulate current by matching the capacitor or RC network value of the LED circuit to the known relatively fixed voltage and frequency of the LED circuit driver whether the LED circuit driver is a mains power source, a high frequency LED circuit driver or other LED circuit driver capable of providing a relatively fixed voltage and relatively fixed frequency output.

According to other aspects of the invention, the LED circuit driver may be coupled to a dimmer switch that regulates voltage or frequency or may have integrated circuitry that allows for adjustability of the otherwise relatively fixed voltage and/or relatively fixed frequency output of the LED circuit driver. The LED circuits get brighter as the voltage and/or frequency of the LED circuit driver output is increased to the LED circuits.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a schematic view of a preferred embodiment of the invention;

FIG. 2 shows a schematic view of a preferred embodiment of the invention;

FIG. 3 shows a schematic view of a preferred embodiment of the invention;

FIG. 4 shows a schematic view of a preferred embodiment of the invention;

FIG. 5 shows a schematic view of a preferred embodiment of the invention;

FIG. 6 shows a schematic view of a preferred embodiment of the invention;

FIG. 7 shows a schematic view of a preferred embodiment of the invention;

FIG. 8 shows a schematic view of a preferred embodiment of the invention;

FIG. 9 shows a schematic view of a preferred embodiment of the invention;

FIG. 10 shows a schematic view of a preferred embodiment of the invention;

FIG. 11 shows a schematic view of a preferred embodiment of the invention; and,

FIG. 12 shows a schematic view of a preferred embodiment of the invention;

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIG. 1 discloses a schematic diagram of a multi-voltage and/or multi-brightness LED lighting device 10. The multi-voltage and/or multi-brightness LED lighting device 10 comprises at least two AC LED circuits 12 configured in a imbalanced bridge circuit, each of which have at least two LEDs 14. The at least two AC LED circuits have electrical contacts 16a, 16b, 16c, and 16d at opposing ends to provide various connectivity options for an AC voltage source input. For example, if 16a and 16c are electrically connected together and 16b and 16d are electrically connected together and one side of the AC voltage input is applied to 16a and 16c and the other side of the AC voltage input is applied to

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16b and 16d, the circuit becomes a parallel circuit with a first operating forward voltage. If only 16a and 16c are electrically connected and the AC voltage inputs are applied to electrical contacts 16b and 16d, a second operating forward voltage is required to drive the single chip 18. The single chip 18 may also be configured to operate at more than one brightness level "multi-brightness" by electrically connecting for example 16a and 16b and applying one side of the line of an AC voltage source to 16a and 16b and individually applying the other side of the line from the AC voltage source a second voltage to 16b and 16c.

FIG. 2 discloses a schematic diagram of a multi-voltage and/or multi-brightness LED lighting device 20 similar to the multi-voltage and/or multi-brightness LED lighting device 10 described above in FIG. 1. The at least two AC LED circuits 12 are integrated onto a substrate 22. The at least two AC LED circuits 12 configured in a imbalanced bridge circuit, each of which have at least two LEDs 14. The at least two AC LED circuits have electrical contacts 16a, 16b, 16c, and 16d on the exterior of the substrate 22 and can be used to electrically configure and/or control the operating voltage and/or brightness level of the multi-voltage and/or multi-brightness LED lighting device.

FIG. 3 discloses a schematic diagram of a multi-voltage and/or multi-brightness LED lighting device 30 similar to the multi-voltage and/or multi-brightness LED lighting device 10 and 20 described in FIGS. 1 and 2. The multi-voltage and/or multi-brightness LED lighting device 30 comprises at least two AC LED circuits 32 having at least two LEDs 34 connected in series and anti-parallel configuration. The at least two AC LED circuits 32 have electrical contacts 36a, 36b, 36c, and 36d at opposing ends to provide various connectivity options for an AC voltage source input. For example, if 36a and 36c are electrically connected together and 36b and 36d are electrically connected together and one side of the AC voltage input is applied to 36a and 36c and the other side of the AC voltage input is applied to 36b and 36d, the circuit becomes a parallel circuit with a first operating forward voltage. If only 36a and 36c are electrically connected and the AC voltage inputs are applied to electrical contacts 36b and 36d, a second operating forward voltage is required to drive the multi-voltage and/or multi-brightness lighting device 30. The multi-voltage and/or multi-brightness lighting device 30 may be a monolithically integrated single chip 38, a monolithically integrated single chip integrated within a LED package 38 or a number of individual discrete die integrated onto a substrate 38 to form a multi-voltage and/or multi-brightness lighting device 30.

FIG. 4 discloses a schematic diagram of the same multi-voltage and/or multi-brightness LED device 30 as described in FIG. 3 having the at least two AC LED circuits 32 connected in parallel configuration to an AC voltage source and operating at a first forward voltage. A resistor 40 may be used to limit current to the multi-voltage and/or multi-brightness LED lighting device 30.

FIG. 5 discloses a schematic diagram of the same multi-voltage and/or multi-brightness LED device 30 as described in FIG. 3 having the at least two AC LED circuits 32 connected in series configuration to an AC voltage source and operating at a second forward voltage that is approximately two times greater than the first forward voltage of the parallel circuit as described in FIG. 4. A resistor may be used to limit current to the multi-voltage and/or multi-brightness LED lighting device.

FIG. 6 discloses a schematic diagram of a multi-voltage and/or multi-brightness LED lighting device 50. The multi-voltage and/or multi-brightness LED lighting device 50

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comprises at least two AC LED circuits **52**, each of which have at least two LEDs **54** in series and anti-parallel relation. The at least two AC LED circuits **52** have at least three electrical contacts **56a**, **56b** and **56c**. The at least two AC LED circuits **52** are electrically connected together in parallel at one end **56a** and left unconnected at the opposing ends of the electrical contacts **56b** and **56c**. One side of an AC voltage source line is electrically connected to **56a** and the other side of an AC voltage source line is individually electrically connected to **56b** and **56c** with either a fixed connection or a switched connection thereby providing a first brightness when AC voltage is applied to **56a** and **56b** and a second brightness when an AC voltage is applied to **56a**, **56b** and **56c**. It is contemplated that the multi-voltage and/or multi-brightness LED lighting device **50** is a single chip, an LED package, an LED assembly or an LED lamp. The multi-brightness switching capability.

FIG. 7 discloses a schematic diagram similar to the multi-voltage and/or multi-brightness LED device **50** shown in FIG. 6 integrated within a lamp **58** and connected to a switch **60** to control the brightness level of the multi-voltage and/or multi-brightness LED lighting device **50**.

FIG. 8 discloses a schematic diagram a multi-brightness LED lighting device **62** having at least two bridge rectified **68** series LED circuits **69**. Each of the at least two bridge rectified **68** series LED circuits **69** that are connected to and rectified with an LED bridge circuit **68** comprising four LEDs **70** configured in a bridge circuit **68**. The at least two bridge rectified **68** series LED circuits **69** have at least two LEDs **71** connected in series and electrical contacts **72a**, **72b** and **72c**. When one side of an AC voltage is applied to **72a** and the other side of an AC voltage line is applied to **72b** and **72c** individually, the brightness level of the multi-brightness LED lighting device **62** can be increased and/or decreased in a fixed manner or a switching process.

FIG. 9 discloses a schematic diagram the multi-brightness LED lighting device **62** as shown above in FIG. 8 with a switch **74** electrically connected between the multi-brightness LED lighting device **62** and the AC voltage source **78**.

FIG. 9 discloses a schematic diagram of at least two single voltage LED circuits integrated with a single chip or within a substrate and forming a multi-voltage and/or multi-brightness LED device.

FIG. 10 discloses a schematic diagram of a single chip LED bridge circuit **80** having four LEDs **81** configured into a bridge circuit and monolithically integrated on a substrate **82**. The full wave LED bridge circuit has electrical contacts **86** to provide for AC voltage input connectivity and DC voltage output connectivity.

FIG. 11 discloses a schematic diagram of another embodiment of a single chip multi-voltage and/or multi-brightness LED lighting device **90**. The multi-voltage and/or multi-brightness LED lighting device **90** has at least two series LED circuits **92** each of which have at least two LEDs **94** connected in series. The at least two series LED circuits **92** have electrical contacts **96** at opposing ends to provide a means of electrical connectivity. The at least two series LED circuits are monolithically integrated into a single chip **98**. The electrical contacts **96** are used to wire the at least two series LEDs circuit **92** into a series circuit, a parallel circuit or an AC LED circuit all within a single chip.

FIG. 12 discloses a schematic diagram of the same multi-voltage and/or multi-brightness LED lighting device **90** as shown above in FIG. 11. The multi-voltage and/or multi-brightness LED lighting device **90** has at least two series LED circuits **92** each of which have at least two LEDs **94** connected in series. The at least two series LED circuits

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can be monolithically integrated within a single chip or discrete individual die can be integrated within a substrate to form an LED package **100**. The LED package **100** has electrical contacts **102** that are used to wire the at least two series LEDs circuit into a series circuit, a parallel circuit or in anti-parallel to form an AC LED circuit all within a single LED package.

What is claimed is:

1. An LED lighting device comprising:

a first operating LED circuit and at least one additional LED circuit,

at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and

a switch capable of at least one of:

(a) switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit, or

(b) switching the at least one additional LED circuit on or off,

wherein (a) or (b) is selectable by a user switching the switch, and

wherein the LED lighting device is configured to connect to an AC voltage power source.

2. The LED lighting device of claim 1, wherein the switch has at least two positions.

3. The LED lighting device of claim 1, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

4. The LED lighting device of claim 1, wherein the switch is connected between the AC voltage power source and the LED lighting device.

5. The LED lighting device of claim 1, wherein the switching of the switch changes light output of the LED lighting device.

6. The LED lighting device of claim 1, wherein the AC voltage power source includes one of at least two different AC voltage power sources.

7. The LED lighting device of claim 1, further comprising a driver electrically coupled to the switch and at least one of the first operating LED circuit or the at least one additional LED circuit.

8. An LED lighting device comprising:

a first operating LED circuit and at least one additional LED circuit,

at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and

a switch capable of at least one of:

(a) switching a brightness level of at least one of the first operating LED circuit or the at least one additional LED circuit, or

(b) switching the at least one additional LED circuit on or off,

wherein (a) or (b) is selectable by a user switching the switch, and

wherein the LED lighting device is configured to connect to an AC voltage power source.

9. The LED lighting device of claim 8, wherein the switch has at least two positions.

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10. The LED lighting device of claim 8, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

11. The LED lighting device of claim 8, wherein the switch is connected between the AC voltage power source and the LED lighting device.

12. The LED lighting device of claim 8, wherein the switching of the switch changes light output of the LED lighting device.

13. The LED lighting device of claim 8, wherein the AC voltage power source includes one of at least two different AC voltage power sources.

14. The LED lighting device of claim 8, further comprising a driver electrically coupled to the switch and at least one of the first operating LED circuit or the at least one additional LED circuit.

15. An LED lighting device comprising:

a first operating LED circuit and at least one additional LED circuit,

at least one of the first operating LED circuit or the at least one additional LED circuit including at least two LEDs connected in either series or parallel, and the at least one additional LED circuit being configured to emit a different color light compared to the first operating LED circuit; and

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a switch capable of at least one of:

(a) switching a voltage level input to at least one of the first operating LED circuit or the at least one additional LED circuit, or

(b) switching the at least one additional LED circuit on or off,

wherein (a) or (b) is selectable by switching the switch, and

wherein the LED lighting device is configured to connect to an AC voltage power source.

16. The LED lighting device of claim 15, wherein the switch has at least two positions.

17. The LED lighting device of claim 15, wherein the switching of the switch provides at least two different DC forward voltages to at least one of the first operating LED circuit or the at least one additional LED circuit.

18. The LED lighting device of claim 15, wherein the switch is connected between the AC voltage power source and the LED lighting device.

19. The LED lighting device of claim 15, wherein the switching of the switch changes light output of the LED lighting device.

20. The LED lighting device of claim 15, wherein the AC voltage power source includes one of at least two different AC voltage power sources.

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